Academic directors, female directors and corporate governance evidence from China

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ABSTRACT

Board of directors have been studied extensively in corporate governance literature. However, little literature investigates the corporate governance role played by academic independent directors (AIDs). In addition, some literature investigates the corporate governance role of female directors. However, results are mixed. In this thesis, I attempt to explore these questions. All empirical chapters focus on Chinese listed companies.

The first objective of this dissertation is to investigate the corporate governance role of academic independent directors (AIDs, hereafter). The second is to investigate the corporate governance role of female (independent) directors. To achieve these objectives, this dissertation focuses on the following research questions. Firstly, it investigates the corporate governance role of AIDs, particularly focusing on the relationship between AIDs and firm performance. Secondly, it investigates the market reaction to the resignation of independent directors (i.e., IDs) and academic independent directors (i.e., AIDs). Thirdly, it investigates the corporate governance role of female (independent) directors, particularly focusing on the relationship between female (independent) directors and firm performance.

The sample include all listed companies in China, between 2004 to 2016. The first empirical chapter investigates the relationship between AIDs and firm performance by OLS regression and Difference-in-difference model. overall, this study finds no evidence about the influence of AIDs on firm performance. AIDs have influence on firm performance only when AIDs hold senior academic position, such as PhD supervisor post. This study uses various methods to do data analysis and find the similar results. The second empirical chapter investigates the shareholder wealth effect of directors' departure, i.e., the market reaction to the announcement of directors' departure, particularly focusing on the AIDs' departure. If AIDs do add value to the firm, the market should respond *negatively* when AIDs leave their jobs as independent directors. The market

reaction to the resignation of AIDs is positive. This result is opposite to the expectation if AIDs are beneficial to the firm. This is because if AIDs are beneficial to the firm, investors should view the departure of the AIDs as bad news and the market should respond negatively to the resignation of AIDs. However, this study finds the opposite results. The third empirical chapter investigates the relationship between female (independent) directors and firm performance. The OLS and fixed effect results indicate that there is relationship between female (independent) directors and firm performance. However, the system GMM results show that there is not association between female (independent) directors and firm performance.

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Abbreviations	Full Terms
AIDs	Academic Independent Directors
DID	Differences in Differences
FDs	Female Directors
FIDs	Female Independent Directors
FE	Fixed Effect
IDs	Independent Directors
OLS	Ordinary Least Squares
ROA	Return on Assets
ROE	Return on Equity
System GMM	System Generalized Method of Moments
TQ	Tobin's Q

Chapter 1 INTRODUCTION

1.1 The Background of Listed Companies in China

At first, I elaborate the background of listed companies in China. There are two stock exchanges in China. One is Shanghai stock exchange and the other is Shenzhen stock exchange. The Shanghai stock exchange was established in 1990 and the Shenzhen stock exchange was established in 1991. There is a significant increase in the number of companies listed in both Shanghai Stock Exchange and Shenzhen Stock Exchange since they were established. In Table 1.1, it shows that there were 8 companies listed in Shanghai Stock Exchange in 1990. This number increased to 1,450 in year 2018. There was only 6 companies listed in Shenzhen Stock Exchange in 1991, while this figures increased to 2,134, making the total number of companies listed in both Shanghai Stock Exchange and Shenzhen Stock Exchange more than 3,500 including all firms listed in Main Board, Small and Medium Board, and ChiNext Board.

In addition, the market capitalization of Shanghai Stock Exchange is 26956 billion RMB in 2018 and the market capitalization of Shenzhen Stock Exchange is 16542 billion RMB in 2018. The total market capitalization in China is 43,492 billion RMB (i.e., equivalent to 6,324 billion USD) in 2018, which makes China as one of the largest stock markets around the world. It is larger than other countries except the United States, in which the total market capitalization was more than 30,000 billion USD in 2018.

Overall, the Chinese stock markets developed dramatically over the last three decades both in terms of the total number of listed companies and in terms of market capitalization.

Table 1.1 Number of listed companies and market capitalization in China's stock market

Year	Number of Listed Companies in Shanghai Exchange	Number of Listed Companies in Shenzhen Exchange	Total Number of Listed Companies	Market Capitalization in Shanghai Exchange (RMB billion)	Market Capitalization in Shenzhen Exchange (RMB billion)	Total Capital Capitalization (RMB billion)
1990	8	-	8	1.234	-	-
1991	8	6	14	2.943	-	-
1992	29	24	53	55.839	48.974	104.813
1993	106	77	183	219.569	133.532	353.101
1994	171	120	291	260.013	109.048	369.061
1995	188	135	323	252.566	94.862	347.428
1996	293	237	530	547.781	436.457	984.238
1997	383	362	745	921.807	831.117	1752.924
1998	438	413	851	1062.59	887.973	1950.564
1999	484	463	947	1458.047	1189.070	2647.117
2000	572	514	1086	2693.086	2116.008	4809.094
2001	646	508	1154	2759.056	1593.163	4352.219
2002	715	508	1223	2536.372	1296.540	3832.912
2003	780	505	1285	2980.492	1265.279	4245.771
2004	837	536	1373	2601.434	1104.122	3705.556
2005	834	544	1388	2309.613	933.414	3243.028
2006	842	579	1421	7161.238	1779.151	8940.389
2007	860	670	1512	26983.887	5730.201	32714.09
2008	864	740	1604	9725.191	2411.453	12136.64
2009	870	830	1700	18465.523	5928.389	24393.91
2010	894	1169	2063	17900.724	8641.535	26542.259
2011	931	1141	2072	14837.622	6638.187	21475.809
2012	954	1540	2494	15869.844	7165.918	23035.762
2013	953	1536	2489	15116.527	8791.192	23907.719
2014	995	1618	2613	24397.402	12857.283	37254.685
2015	1081	1746	2827	29519.420	23610.999	53130.419
2016	1182	1870	3052	28460.763	22307.825	50768.588
2017	1396	2089	3485	33132.482	23576.125	56708.607
2018	1450	2134	3558	26951.501	16540.901	43492.402

Data Source: Shanghai Stock Exchange fact-books and Shenzhen Stock Exchange fact-books.

1.1.1 Independent Director in Chinese Listed Companies

Before 2001, listed Chinese companies can decide at their sole discretion whether to hire external independent directors or not. In order to improve the governance structure of listed companies and promote their compliant operation, China Securities Regulatory Commission issued the Guiding Opinions on Establishing an Independent Director System in Listed Companies on August 16th 2001 and started to require all listed companies to establish an independent director system inside themselves. The Opinions also required all listed companies to have at least 2 independent directors on their board before June 30th, 2002 and no lower than 1/3 independent directors on their board before June 30th, 2003.

One of the main reasons why CSRC introduced the system of independent director is to guard against the "hollowing-out" of listed companies by the insiders (major shareholders) and protect the interests of small and medium investors (Kangtao Y et al., 2007). In order to achieve this, the reform of the independent director system also implemented a series of institutional arrangements that are designed to address the "hollowing out" acts of major shareholders. For example, the Guiding Opinions stipulated that listed companies should grant some special powers to the independent directors: "Major related-party transactions (proposed transactions between the listed company and the related party with a total value of over RMB 3 million or higher than the 5% of the recent audited net asset value of the listed company) must be approved by independent directors and submitted to the board of directors for discussion"; "Independent directors shall issue independent opinions on major affairs of the company, such as borrowing activities or other capital transactions with a total value of over RMB 3 million or higher than 5% of the recent audited net asset value of the listed company, as well as whether the company has taken effective measures to recover the arrears".

In order to further enhance the independence of independent directors and ensure their effective performance of supervisory function, both Shanghai Stock Exchange and Shenzhen Stock

Exchange have set compulsory regulations in the "Rules Governing the Listing of Stocks" (2004 Amendment), which require listed companies to make timely disclosures of board decisions and announcements regarding major affairs of the company, including information about the "the number of votes for approval, objection and abstention on each board meeting proposal, as well as the reasons for the director's objection or abstention". In addition, "For issues that require the prior approval or independent opinions from the independent directors, relevant approval or opinions should also be disclosed and explained to the public." According to the research by Kangtao Y et al. (2011), other countries do not require their listed companies to announce their board meetings votes to the public. China is the only country that imposes compulsory disclosure of such information. Based on the votes and specific opinions issued by an independent director on board meeting proposals, we are able to identify the independence that independent director has managed to maintain from the management of the company.

Under the institutional background of China, the motivation for the independent directors to perform their duties is to avoid reputational and legal risks (Qingquan T et al., 2006; Kangtao Y et al., 2011). From the perspective of reputational risk, the independent director system of listed Chinese companies is mainly comprised by prominent figures in education or business fields. These people are usually very successful in their own areas of focus, which means that they also hold relativity high social status and good reputation in their respective industry. As an elite social group, they attach great importance to their personal reputation (Qingquan T et al., 2006). Under such circumstances, when major legal or operational problem emerge in the company where the independent director performs his/her duty, the social reputation of the director himself/herself would also be severely undermined. Existing empirical studies have shown that reputational incentive is the main mechanism for the performance of governance function by the independent directors in listed Chinese companies (Fan Z et al., 2008; Yan L et al., 2011). In terms of the legal risks, according to Article 118 of the Company Law of the People's Republic of China (1999 Amendment), "Directors shall bear the responsibilities for the resolutions adopted at the meeting

of the board of directors. If the resolutions adopted at the board meeting have violated the law, administrative decrees, or the articles of association and incurred serious losses to the company, the directors that participate in the resolution are liable to compensate the company. But if a director can be proven expressly objecting to the resolutions and that the objection had been recorded in the minutes of meetings, the director per se may be exempt from the responsibilities". In addition, Article 212 stipulates that "If a company is found to have provided false financial and accounting statements or concealed important facts in the reports to shareholders or the public, the responsible person(s) directly in charge and other persons directly responsible shall be imposed of a fine of RMB10,000 to RMB100,000. If the case is serious enough to constitute a crime, criminal responsibility shall be affixed according to law". These provisions also apply to independent directors.

Table 3.2 shows the information about the board of directors of the listed companies on Main Board in China. Firstly, the total number of directors sitting on the board in listed companies in China was 12,234 in year 2003, while this number increased to 16,073 in year 2018. This is consistent with the increase of listed companies in China from year 2003 to year 2018. In addition, the total number of independent directors also increased from 3,982 in year 2003 to 5972 in year 2018. Secondly, the average number of directors sitting on the board is quite stable during the sample period. The range is between 8.68 and 9.84. Thirdly, the average number of independent directors sitting on the board is also quite stable during the sample period. This range is between 3.20 and 3.36. These figures indicate that on average there are more than three independent directors sitting on the board and slightly more than one third of directors sitting on the board are independent directors. This is consistent with the corporate governance requirement- "Guiding Opinions on Establishing an Independent Director System in Listed Companies" states that before June 30, 2002, the board of directors should include at least 2 independent directors, while after June 30, 2003, the board of directors of a listed company should include at least a third of independent directors.

Table 1.1.1: The Average Number of Independent Directors Sitting in Board

Year	Firm Number	Total Directors	Total Independence Directors	Average Number of Directors	Average Number of Independence Directors
2003	1243	12234	3982	9.84	3.20
2004	1294	12563	4271	9.71	3.30
2005	1283	12265	4237	9.56	3.30
2006	1287	12134	4236	9.43	3.29
2007	1272	11943	4250	9.39	3.34
2008	1263	11716	4204	9.28	3.33
2009	1298	11934	4306	9.19	3.32
2010	1319	12110	4410	9.18	3.34
2011	1354	12405	4538	9.16	3.35
2012	1380	12672	4638	9.18	3.36
2013	1383	12625	4641	9.13	3.36
2014	1437	12879	4715	8.96	3.28
2015	1503	13255	4899	8.82	3.26
2016	1631	14375	5293	8.81	3.25
2017	1815	15768	5837	8.69	3.22
2018	1852	16073	5972	8.68	3.22
2019	592	5160	1925	8.72	3.25

1.1.2 Academic Independent Director in Chinese Listed Companies

Around the world, many companies have academic professors sitting on the board as non-executive directors. For example, in US, approximately 40% of SP1,500 firms had at least one academic professor sitting on the board as non-executive directors during the period of 1998 to 2011. More than 76% firms have at least one academic professor as non-executive director in China.

Table 1.1.2: Additional Post of Academic Director

Number of Additional Firms	Number of AD	Percentage
0	11114	41.86%
1	5647	21.27%
2	3964	14.93%
3	3035	11.43%
4	2172	8.18%
5	472	1.78%
6	127	0.48%
7	19	0.07%
Total	26550	100.00%

1.1.3 Female Independent Director in Chinese Listed Companies

There are female independent director serving on the board is an important indicator of board diversity. Many studies investigate the impact of female directors on firm performance. However, their findings are mixed. For example, Carter, Simkings, and Simpson (2003) and Campbell and Minguez-Vera (2008) find that the percentage of female directors has positive impact on firm performance. Levi, Li, Zhang (2014) find that female directors are beneficial in creating shareholder value through reducing bid premium. Liu, Wei, and Xie (2014) find a positive association between female directors and firm performance. On the contrary, Ahern and Dittmar (2012), Bohren and Staubo (2014) document that imposing the quota of 40% female directors sitting on the board is detrimental to the firm value. Adams and Ferreira (2009) find a positive association between female directors and corporate governance, such as attending board meeting and playing monitoring role. However, they did not find evidence about the positive association between female directors and firm performance. Triana, Miller, and Trzebiatowski (2013) show that board gender diversity is a double-edged sword as it depends on the firm performance and the power of female directors.

1.2 Motivation

The independent director system has long been considered as one of the core mechanisms that alleviate the agency problem between the shareholders and the management inside a company. Board of directors have been studied extensively in corporate governance literature. Some literature discusses the role of board composition. For example, Guner, Malmendier, and Tate (2008) present a research on the *financial outside directors*. Baker and Gompers (2003) study the *venture capital investors* as directors. In addition, some other studies also discuss the CEOs as outside directors of other companies. Fich (2005) finds that the market response to the adding *CEOs of well-performing firms* to the board is positive. Fahlenbrach et al. (2010) show that the company's performance is down when the *interlocking directorates* joined the company. Seary, and Tuna (2005) present that *interlock directors* receive abnormally high pay. Several other papers investigate the *lobar representation* on the board, such as Faleye et al (2006). Around the world, many companies have academic professors sitting on the board as non-executive directors. For example, in US, approximately 40% of SP1,500 firms had at least one academic professor sitting on the board as non-executive directors during the period of 1998 to 2011. More than 76% firms have at least one academic professor as non-executive director in China. The independent director system of listed Chinese companies is mainly comprised by prominent figures in education or business fields. However, little literature discusses board composition from the perspective of academic professors sitting on the board as independent directors. This is one focus of this dissertation.

On the other hand, whether independent directors can play their intended roles effectively has been a controversial issue both in practice and academic research. For example, the existing literature only found weak evidence of a significant correlation between the proportion of independent directors in the board and the corporate performance (Bhagat and Black, 2001; Hermalin and Weisbach, 2003; Changqing Li and Jianqing Lai, 2004; Yuetang Wang et al., 2006). One of the major reasons behind this is the fact that board structures often have endogenous

factors that are rooted in corporate-level features such as historical performance and shareholding structure of the company, which has made it difficult to examine the roles played by the independent directors from the empirical perspective in a reliable manner (Hermalin and Weisbach, 2003; Harris and Raviv, 2008) ; Adams et al., 2010). This suggests that appointments or resignations of AIDs cannot be regarded as exogenous to firms' needs and the market reaction to such appointments or resignations is not informative to evaluate the value of AIDs. To avoid this concern, I need to find a "true" exogeneous shock causing the appointments or resignation of AIDs. Since the issue of Regulation 11, many university professors resigned their directorship from the listed companies they serve. Regulation 11 was not expected by the listed companies. Thus, resignations of AIDs can be regarded as exogenous to firms' needs and the market reaction to such resignations is informative on evaluating the value of AIDs. This is one of motivations.

In addition, the literature on the corporate governance role of female directors is still inconclusive. For example, Carter, Simkings, and Simpson (2003) and Campbell and Minguez-Vera (2008) find that the percentage of female directors has positive impact on firm performance. Levi, Li, Zhang (2014) find that female directors are beneficial in creating shareholder value through reducing bid premium. Liu, Wei, and Xie (2014) find a positive association between female directors and firm performance. On the contrary, Ahern and Dittmar (2012), Bohren and Staubo (2014) document that imposing the quota of 40% female directors sitting on the board is detrimental to the firm value. Adams and Ferreira (2009) find a positive association between female directors and corporate governance, such as attending board meeting and playing monitoring role. However, they did not find evidence about the positive association between female directors and firm performance. Triana, Miller, and Trzebiatowski (2013) show that board gender diversity is a double-edged sword as it depends on the firm performance and the power of female directors. Thus, another focus of this dissertation is about corporate board composition from the perspective of the female (independent) directors.

1.3 Aims

The first aim of this dissertation is to investigate the corporate governance role of academic independent directors (AIDs, hereafter). The second aim of this dissertation is to investigate the corporate governance role of female (independent) directors.

1.4 Research Questions

To achieve the aim about the corporate governance role of AIDs, this dissertation focuses on the following research questions: 1) what is the relationship between the presence of AIDs and firm performance? 2) what is the relationship between the different number of AIDs sitting on the board and firm performance? 3) what is the relationship between characteristic of AIDs and firm performance? (include school affiliation, administrative position, academic position, various subject expertise) This is the focus of the first empirical chapter-Chapter 2.

In addition, this dissertation also investigates the market reaction to the resignation of independent directors and AIDs as I want to investigate the value of independent directors and AIDs from the perspective of investors. This is the focus of the second empirical chapter-Chapter 3.

To achieve the aim of corporate governance role of female (independent) directors, this dissertation focuses on the following research questions: 1) what is the relationship between the number and the percentage of female directors and firm performance? 2) what is the relationship between the number and the percentage female independent directors and firm performance? This is the focus of the third empirical chapter-Chapter 4.

1.5 Why China?

Why I focus on China to investigate the above questions? There are several reasons. Regarding AIDs, AIDs are pervasive in China and therefore China is an idea setting to investigate the corporate governance role of AID. In my sample, 76% companies in China have at least one academic professor (researcher) sitting on the board as non-executive directors. 44% companies in China have at least two academic professors (researchers) sitting on the board as non-executive directors. Second, the studies investigating the relationship between AIDs and firm performance in China has not been explored, most existing studies focus on western countries such as US. Francis, Hasan and Wu (2015) study the relationship between AIDs and firm performance focusing on US. White et.al. (2014) explored the appointment of academic directors in US.

Regarding female (independent) directors, many listed firms in China have female (independent) directors. Around 69% listed firms in China has at least one female director sitting on the board as directors and around 34% listed firms in Chin has at least one female independent director sitting on the board as independent directors. Similar to AIDs, many existing studies investigating the corporate governance role of female (independent) directors focus on developed countries, such as US, few studies focus on developing countries, such as China.

Compared with researches based on developed market economies such as Britain and the US, efforts targeted at identifying the governing function of independent directors in listed Chinese companies would probably face severer endogenous problems. Unlike European and American companies with decentralized shareholding structure, the ownership structure of listed Chinese companies is characterized by the highly centralized shareholding system, which puts the company under the control of one or a few owners. In addition, the Chinese legal system has provided relatively weak protection for the investors. The major shareholders are able to make sizeable personal gains through their controlling right over the company. As a result, they have strong

incentives to infringe upon the interests of small and medium shareholders through capital appropriation, related-party transactions, inter-company loans, etc. (Zengquan Li et al., 2004; Jian and Wong, 2010; Jiang et al., 2010). For such companies, the core issue of corporate governance is to protect the interests of small and medium shareholders from the infringing act of major shareholders and the management under their control (Shleifer and Vishny, 1997; Johnson et al., 2000; Berkman et al., 2010). Major shareholders often have strong controlling power over the decision-making of the company. They can determine the size and structure of the board of directors to a very large extent, including the number of independent directors to be appointed and their proportion in the board of directors. In order to undermine the check and supervision such independent directors would have against the "hollowing-out" of the company, major shareholders are incentivized to use their sway over the board of directors to influence the selection and hiring process of independent directors. The greater the supervisory effect of independent directors on the major shareholders, the weaker the willingness of major shareholders to bring in independent directors. As a result, based on what we've observed, the proportion of independent directors in such companies is in fact lower. Therefore, given that China has different institutional background, the findings found based on Western developed countries may not apply to China. Overall, these are the main reasons why I focus on China in this dissertation.

1.6 Main Research Findings

The main research findings of the first empirical chapter-Chapter 4 include 1) there is no evidence about the effect of the presence of AIDs sitting on the board on firm performance; 2) there is no evidence about the effect of the number of AIDs sitting on the board on firm performance; 3) there is no evidence about the effect of school affiliation of AIDs on firm performance; 4) there is no evidence about the effect of administrative position of AIDs on firm performance; 5) there

is some evidence about the effect of academic position of AIDs on firm performance. Particularly, firms with AIDs with senior academic position perform better than firms with AIDs without senior academic position; 6) there is no evidence about the effect of subject expertise of AIDs on firm performance. Overall, based on the sample used in this study, I find no evidence about the effect of AIDs on firm performance.

The main research findings of the second empirical chapter-Chapter 5 include 1) the market responds positively to the announcement of the departure of independent directors (IDs). In particular, the abnormal return is 0.018% on the announcement date (e.g., T=0) of departure of independent directors and is also significant at 1% significance level. 2) the CARs about the departure of independent directors (IDs) over various windows are positive and significant at 1% significance level. For example, CAR at window [-1,1] is 0.025% and significant at 1% significance level. These results indicate that investors do not view independent directors are beneficial to the firm based on the sample I used in this study. 3) the market responds positively to the announcement of the departure of AIDs. In particular, the abnormal return is 0.004% on the announcement date (e.g., T=0) of departure of independent directors and is also significant at 10% significance level. 4) the CARs about the departure of academic independent directors (AIDs) over various windows are positive and significant at 1% significance level. For example, CAR at window [-1,1] is 0.008% and significant at 1% significance level. These results indicate that investors do not view AIDs beneficial to the firm based on the sample I used in this study.

The main research findings of the third empirical chapter-Chapter 6 include 1) the OLS estimation results about the relationship between female directors (FDs) and firm performance show that there is no relationship between the existence of female directors and firm performance. However, there is a significant positive association between the number of female directors and firm performance and there is a significant positive association between the percentage of female directors and firm performance. 2) The OLS estimation results about the relationship between

female independent directors (FIDs) and firm performance show that there is a significant positive association between the existence of female independent directors, the number of female independent directors, and percentage of female independent directors and firm performance. 3) The fixed effect estimation results show that there is no association between the presence of female directors, the number of female directors, the percentage of female directors and firm performance. There is a significant positive association between female independent directors, the number of female independent directors, the percentage of female independent directors and firm performance. 4) the system GMM results show that there is no association between the presence of female (independent) directors, the number of female (independent) directors, the percentage of female (independent) directors and firm performance.

These findings indicate that different model specifications lead to different results. Given that OLS estimation results do not consider the endogeneity issue, the results are relatively weak. The fixed effect estimation results assume that there is a time-constant omitted variable bias, which is a strong assumption. The system GMM results might be more reliable considering the dynamic characteristics of model, which means that the current firm performance is related to past firm performance.

In addition, chapter 6 also investigates the market reaction to the resignation of female (independent) directors. It uses market model, Fama-French three factor, Fama-French five factor model to calculate the expected return and in turn calculate the abnormal return and cumulative abnormal return. Both results show that there is no significant market reaction to the resignation of female (independent) directors. These results are consistent with the regression analysis results.

1.7 Contributions

This dissertation contributes to the existing literature in several ways. Firstly, this study contributes to the existing literature about the corporate board composition. Previous literature about corporate board composition mainly focuses on directors coming from financial outside directors (e.g., Guner, Malmendier, and Tate, 2008), venture capital investors (e.g., Baker and Gompers, 2003), CEOs of other companies (e.g., Fich, 2005), employees of the firm (e.g., Faleye et al, 2006) etc. Few studies focus on academic professor and female sitting on the board as independent directors. This paper supplements and advances the recent literature on the academic and female director from the perspective of the agency problem.

Secondly, this study contributes to the existing literature in findings as the main findings of this study are not consistent with the main findings of existing studies. For example, previous empirical studies about the relationship between AIDs and firm performance find a positive association between AIDs on firm performance (e.g., Francis, Hasan and Wu, 2015; White et.al., 2014). They argue that AIDs are beneficial to the firm because of their reputation, expertise, social ties etc. However, this study finds that there is no association between AIDs on firm performance unless the AIDs hold senior academic position. The findings of no association between AIDs and firm performance indicates that the roles played by academic professors as independent directors are not what the existing literature claimed. These may due to the reason that academic professors are too busy to play monitoring role and advising role effectively, or they do not have relevant knowledge about business practice etc. Thirdly, this study contributes to the broad literature about the corporate governance of board structure as the main literature investigating the corporate governance role of board structure focuses on Western countries and few studies focus on Eastern countries, like China.

Thirdly, through the skillful use of exogenous policy impact brought by the reform of independent director system, this paper constructs a difference-in-differences estimation model with panel data to examine how independent director governance system impacts the firm performance, and thus effectively addresses the endogenous problem. Finally, the research in this paper can provide new perspectives and evidences for understanding and evaluating the policy effects of independent director system inside the listed Chinese companies.

1.8 Structure of this dissertation

Chapter 1 is introduction of this thesis, include background of Chinese listed company, motivation, aims, research questions, why China, main research findings and contribution. Chapter 2 is the first empirical chapter- the relationship between AIDs and firm performance. Chapter 3 is the second empirical chapter- the market reaction to the resignation of AIDs and IDs. Chapter 4 is the third empirical chapter- the relationship between female (independent) directors and firm performance. Chapter 5 is the conclusion.

Chapter 2 ACADEMIC INDEPENDENT DIRECTORS (AIDS) AND FIRM PERFORMANCE

2.1 Introduction

Around the world, many companies have academic professors sitting on the board as non-executive directors. For example, in US, approximately 40% of SP1,500 firms had at least one academic professor sitting on the board as non-executive directors during the period of 1998 to 2011. More than 76% firms have at least one academic professor as non-executive director in China. These factors raise several interesting and important questions. Are academic directors effective monitors and/or important advisors? How do academic directors affect firm performance? How do academic directors play corporate governance role? This chapter attempt to shed light on the effectiveness of the oversight and advice functions performed by academic directors, and their impact on firm performance. However, little literature pay attention to the relationship between academic directors and corporate governance and firm performance. These are the motivation of this study.

On the one hand, AIDs might play an important corporate governance role. The reasons include 1) they are more independent, because AIDs have more critical and independent thinking, and whit their own opinions because they are outside directors with high reputation. AIDs are less likely to be influenced by managements. (Jiang and Murphy, 2007); 2) they care more about their reputation. Academic professors care more about their reputations, whereby they can play monitoring role more effectively relative to firms without AIDs. This is particularly true in countries with Confucius culture background, like China, as people in these countries show profound/high/great respect to teachers(Huang et al, 2016); 3) they have relevant expertise(Francis, Hasan and Wu, 2015), Audretsch and Lehmann (2006) argue that directors with academic background may enhance firm's competitive advantage through accessing to and the absorption of external knowledge spillover. Thus, AIDs can increase firm performance by bringing

valuable advice to the firm. Secondly, board diversity can increase firm performance (Carter, Simkins, and Simpson, 2003; Adams and Ferreira, 2009; Anderson et al., 2011; Gul, Srinidhi, and Ng, 2011); 4) they have more external resources and social ties(Westphal, 1999) Resource dependence theory argues that corporations are combinations of tangible and intangible assets. Board of directors can be seen as a strategic resource, which bring value to the firm (Pfeffer and Salancik, 1978). AIDs will provide resource and networks to firms, such knowledge transfer (Audretsch and Stephan,1996), social networks (e.g., Lynall et al., 2003), or loans (e.g., Guner et al., 2008); 5) they receive pecuniary compensation. The average annual salary of AIDs is more than 80,000 RMB in 2017. (annual report), so they have incentive to play corporate governance role etc. On the other hand, AIDs might not play corporate governance role effectively. The reasons include that 1) they do not have enough time in playing monitoring role and advising role; 2) they do not have relevant expertise in that business industry or business practice; 3) they are invited by controlling shareholders to attend the board as independent directors and they do not have incentive to play monitoring role etc.

The aim of this study is to investigate whether AIDs sitting on the board as non-executive directors play corporate governance as they claimed. To achieve this aim, I focus on the following research questions: 1) what is the relationship between the presence of AIDs and firm performance? 2) what is the relationship between the number of AIDs sitting on the board and firm performance? 3) what is the relationship between school affiliation of AIDs and firm performance? 4) what is the relationship between AIDs with administrative position and firm performance? 5) what is the relationship between academic position of AIDs and firm performance? 6) what is the relationship between AIDs with various subject expertise and firm performance?

To address these research questions, I focus on listed companies in China. First, AIDs are pervasive in China. In my sample, 76% companies in China have at least one academic professor

(researcher) sitting on the board as non-executive directors. 44% companies in China have at least two academic professors (researchers) sitting on the board as non-executive directors. Second, the studies investigating the relationship between AIDs and firm performance in China has not been explored, most existing studies focus on western countries such as US. Francis, Hasan and Wu (2015) study the relationship between AIDs and firm performance focusing on US. White et.al. (2014) explored the appointment of academic directors in US.

We find the following results. Firstly, I find no evidence about the effect of the presence of AIDs sitting on the board on firm performance. Secondly, find no evidence about the effect of the number of AIDs sitting on the board on firm performance. Thirdly, I find no evidence about the effect of school affiliation of AIDs on firm performance. Fourthly, I find no evidence about the effect of administrative position of AIDs on firm performance. Fifthly, I find some evidence about the effect of academic position of AIDs on firm performance. Particularly, firms with AIDs with senior academic position perform better than firms with AIDs without senior academic position. Lastly, I find no evidence about the effect of subject expertise of AIDs on firm performance. Overall, based on the sample used in this study, I find no evidence about the effect of AIDs on firm performance.

This paper utilizes several approaches to address the endogeneity problem. I employ Fixed Effect to address endogeneity issue coming from time-constant omitted variable, i.e., individual firm effect. I also use difference-in-difference approach to address endogeneity issue coming from omitted variable. Both fixed effect results and difference-in-difference approaches provide the similar results.

We contribute to the literature in the following aspects. Firstly, given the fact that much of the research in board composition is Western-based, this study helps extend existing research to a rich and complex context beyond that of developed counties and contribute to the international literature about the board composition in developing countries (i.e., emerging markets). Secondly,

most existing studies investigating the board composition focus on outside banker directors (e.g., Booth and Deli, 1996, Byrd and Mizruchi, 2005, Güner et al., 2008, Kroszner and Strahan, 2001), outside politically-connected outside directors (e.g., Agrawal and Knoeber, 2001, Goldman et al., 2009), outside CEO directors (e.g., Fich, 2005, Conyon and Read, 2006), labour representation (e.g., Faleye et al., 2006), and venture capitalists (e.g., Baker and Gompers, 2003). This study will investigate board composition by focusing on academic professors. This will fill the gap in the existing literature.

The rest of the paper is structured as follows. In Section 2, I present a brief literature review. Section 3 presents hypothesis development. Section 4 describes the data and methodology. Section 5 shows empirical results. Endogeneity check is showed in Section 6. Robustness check is presented in Section 7. Finally, discussion and conclusion are showed in Section 8.

2.2 Literature Review

2.2.1 Literature Review of Academic Directors

There are several studies investigating the corporate governance role of academic directors. Francis, Hasan, and Wu (FM2015) investigate the relationship between AIDs and firm performance. They focus on US firms and find evidence that firms with AIDs perform better than firms without. In addition, firms with AIDs are associated with greater acquisition performance, a higher number of patents and citations, higher stock price informativeness, lower discretionary accruals, lower CEO compensation, higher CEO forced turnover-performance sensitivity. All these results indicate that AIDs add value to the firm they serve.

White, Woidtke, Black, and Schweitzer (JCF2014) investigate the market reaction to the appointment of AIDs. They find that AIDs tend to be appointed by small and mid-cap firms. AIDs in science, medicine, and engineering appear to be appointed for their expertise and the market reacts favorably. AIDs with administrative role appear to be appointed for their networks, and the market reacts favorably when this administrative role is affiliated with a business school; but negatively when this administrative role is not within close geographic proximity. In addition, AIDs with business professor title appear to be appointed for general expertise and reputation and no significant market reaction to the appointment of business professor as AIDs.

Chen, Garel, Touani-Rad (JCF2019) examine the value of AIDs through investigating the market reaction to the resignation of AIDs. They focus on China and they find that there is a negative market reaction to the AIDs resignations. The results indicate a positive value effect of AIDs to

the firm.

Huang, Lee, Lyu, and Zhu (IRFA2016) investigate whether accounting academics on the board affect firm's financial reporting quality. They find that greater value relevance of reported earnings when accounting academics serve as financial experts in the board, especially in firms where their influence is expected to be more pronounced.

Cho, Jung, Kwak, Lee, and Yoo (JBE2017) investigate the relationship between AIDs and CSR. They find that firms with AIDs have higher CSR performance ratings than those without. In addition, the influence of AIDs on CSR rating depends on their academic background. In particular, the positive association between AIDs and CSR rating is significant only when their academic background is science, engineering, or medicine. However, the positive association weakens when AIDs hold an administrative position at their universities.

Overall, the findings of these studies indicate that AIDs play a positive corporate governance role to the firm and they are valuable to the firm they serve as well.

However, little literature discusses academic independent director focus on Chinese listed companies. Under the institutional background of China, the motivation for the independent directors to perform their duties is to avoid reputational and legal risks (Qingquan T et al., 2006; Kangtao Y et al., 2011). From the perspective of reputational risk, the independent director system of listed Chinese companies is mainly comprised by prominent figures in education or business fields. These people are usually very successful in their own areas of focus, which means that they also hold relativity high social status and good reputation in their respective industry. More than 76% firms have at least one academic professor as non-executive director in China.

On the other hand, little literature effectively to reduce the endogeneity problems. Compared with researches based on developed market economies such as Britain and the US, efforts targeted at identifying the governing function of independent directors in listed Chinese companies would probably face severer endogenous problems. Unlike European and American companies with decentralized shareholding structure, the ownership structure of listed Chinese companies is characterized by the highly centralized shareholding system, which puts the company under the control of one or a few owners. In addition, the Chinese legal system has provided relatively weak protection for the investors. The major shareholders are able to make sizeable personal gains through their controlling right over the company. As a result, they have strong incentives to infringe upon the interests of small and medium shareholders through capital appropriation, related-party transactions, inter-company loans, etc. (Zengquan L et al., 2004; Jian and Wong, 2010; Jiang et al., 2010). Therefore, there are the gaps I found. This chapter research the relationship between academic independent director and firm performance focus on China, and effectively to reduce the endogeneity problems.

2.2.2 Literature Review of Board Composition

There are substantial academic articles research the board composition on different sides of this issue. Papers include board size, board independent, board composition and determinates of board structure.

Board Size

Lipton and Lorsch (1992) argue that although larger boards have better monitoring capacities, this benefit are outweighed by costs such as less effective decision-making, less-candid discussions of CEO performance. Jensen (1993) point out that 'great emphasis on politeness and courtesy at the expense of truth and frankness in boardrooms' and ' when board get beyond seven or eight people, they are less likely to function effectively and are easier for the CEO to control'. Overall, these views indicate that larger boards are less effective due to communication problem among board of directors, while smaller boards are more effective in monitoring CEOs and more productive, thereby have better firm performance and valuation.

Board Independence

In corporate governance, the principal-agent problem is an important issue. Because there are different purposes between agents and clients. Appointed managers (agents) pay more attention to personal interests and developments, thus affecting the interests of shareholders (clients). In the principal-agent problem, independent directors are considered the most effective managers, can minimize the opportunism of managers. Independent directors are the primary role for avoiding the management of misappropriation, in the scattered ownership of the companies at United States and the United States. In concentrated ownership system at continental Europe, when the larger shareholder acquires a private interest by appointing other board members, the role of independent directors is to inhibit this behaviour. A widely accepted concept in academia is that, the board of supervisors depends on the effectiveness of the independent directors. (Adams and Ferreira, 2007; Adams et al., 2008; Bhagat and Black, 2002; Dyck and Zingales, 2004; Hermalin and Weisbach, 2003). There are also some laws and regulations stated that, for example, the Commission of the

European Communities Recommendation, the OECD Principles of Corporate Governance of 2004, the final corporate governance rules of the New York Stock Exchange of 2009, as well as all relevant existing systems of corporate governance. In fact, the European Commission Recommendation of 2005 pointed out independent directors are effective in diversified ownership of firms. The main role is to make managers responsible for the interests of shareholders, as well as controlling large shareholder of the company must consider the interests of small shareholders.

Board Composition

With the enactment of the Sarbanes-Oxley Act in 2002, there is a clear provision for board composition. It stipulates that most directors of the company must be independent directors. Moreover, the three most influential committees on the board, the audit, corporate governance committees and compensation must be independent. Linck et al. (2009) investigate the requirements of independence and they find that the number of outside directors increases significantly in the post-Sarbanes-Oxley Act period.

Although there is no clear definition of board gender issues, but the Sarbanes-Oxley Act of gender diversity on the Board of Directors had an impact. Dalton and Dalton (2010) investigation the number of female directors who serve on the board and they find that there is a rising trend over the past 20 years. The promulgation of the Sarbanes-Oxley Act further accelerates this trend. Female directors on the Fortune 500 boards rose by 30%, women held leadership positions on the board up by 200% after the enactment of the Sarbanes-Oxley Act.

Overall, enactment of the Sarbanes-Oxley Act has a significant impact on board composition. Linck et al. (2009) and Valenti (2007) find that both the number of external directors and the

number of female directors in most companies increase after the enactment of the Sarbanes-Oxley Act.

Determinates of Board Structure

The biggest issue of controversy for the modern corporate governance system is influence of the structure of the board of directors on the behavior of enterprises. State law regulates corporate governance, and widely respect for legal business transactions authorized by law, according to the business to determine the rules (Cox and Hazen, 2003, p. 185). Prior to SOX, Security Laws place no provisions on board structure. In addition, court did not provide any guide for the board structure, because it is difficult (Karmel, 1984). Fisch (1997) investigate legal flexibility and find that allowing companies to adjust the structure of the board to the most important functions is effective. Therefore, determinants of board structure are important to corporate governance.

2.2.3 Review Relevant Theories about Academic Directors

Agency Theory

Due to the separation between ownership and control, (i.e., a firm is owned by shareholders while it is controlled by managers), there is a conflict of interest between managers and shareholders. For example, inside managers are accustomed to investing the rest of the company's earnings in suboptimal marginal investments; managers have incentive to increase the size of firm to do empire building although this has no interest to shareholders; managers might have excessive wages and consumption etc. (Jensen and Meckling, 1976; Grosssman and Hart, 1988; Jensen, 1986). This is

referred as the *principal-agent problem*. In this case, the shareholders are the principal while the managers are the agent.

Monitoring and resolving agency problems are generated because the conflict of interest between firm internal and external shareholders is the basic responsibility of corporate governance (Jensen and Meckling, 1976; Fama, 1980; Fama and Jensen, 1983).

In countries where company ownership is more dispersed, it is the appointed manager who exercises decisions on behalf of the shareholders, such as United Kingdom, United Status, and Canada. However, managers may be more concerned about their own interests, abuse company resources and time to seek benefits for themselves, rather than creating maximum shareholder value (Jensen and Meckling, 1976).

In most countries of the world, ownership of corporate is concentrated. Controlling shareholder is the principal owner, who control decision-making, even by their own management company (La Porta and Lopez-de-Silanes, 1999). In these countries, the main control of shareholder management is most likely to sacrifice the interests of external shareholders. Because external shareholders are likely to be a minority under normal circumstances.

Compared with researches based on developed market economies such as Britain and the US, efforts targeted at identifying the governing function of independent directors in listed Chinese companies would probably face severer endogenous problems. Unlike European and American companies with decentralized shareholding structure, the ownership structure of listed Chinese companies is characterized by the highly centralized shareholding system, which puts the company under the control of one or a few owners. In addition, the Chinese legal system has provided

relatively weak protection for the investors. The major shareholders are able to make sizeable personal gains through their controlling right over the company. As a result, they have strong incentives to infringe upon the interests of small and medium shareholders through capital appropriation, related-party transactions, inter-company loans, etc. (Zengquan Li et al., 2004; Jian and Wong, 2010; Jiang et al., 2010). For such companies, the core issue of corporate governance is to protect the interests of small and medium shareholders from the infringing act of major shareholders and the management under their control (Shleifer and Vishny, 1997; Johnson et al., 2000; Berkman et al., 2010). Major shareholders often have strong controlling power over the decision-making of the company. They can determine the size and structure of the board of directors to a very large extent, including the number of independent directors to be appointed and their proportion in the board of directors. In order to undermine the check and supervision such independent directors would have against the "hollowing-out" of the company, major shareholders are incentivized to use their sway over the board of directors to influence the selection and hiring process of independent directors. The greater the supervisory effect of independent directors on the major shareholders, the weaker the willingness of major shareholders to bring in independent directors. As a result, based on what we've observed, the proportion of independent directors in such companies is in fact lower. At this time, hiring independent directors can play the role to monitor managers.

Stakeholder Theory

Stakeholder theory argue that exclusive focus on shareholder interests has not held the key to good corporate governance. Good corporate governance should take care of not just the interest of shareholders (i.e., equity contributors), but also the interest of other stakeholders, such as suppliers, society, government, employees,

managers, creditors, and customers etc. Therefore, the appointment independent directors are also valuable in order to ensure the interests of stakeholders. Academic director will improve the better monitor than other independent director that because academic director pays more attention to reputation, and female director will more careful to monitor, so I have tested the effect of academic and female directors to firm performance.

Resource Dependence Theory

Resource dependence theory arise from economics and sociology subjects about the distribution of power in a firm. The resource dependence theory was developed by Pfeffer and Salancik (1978) and later by Zahra and Pearce (1989). It argues that corporations are combinations of tangible and intangible assets. Board of directors can be seen as a strategic resource, which bring value to the firm. The theory of resource dependence (Pfeffer and Salancik, 1978) assumes that companies rely on resources in the external environment to survive. In order to reduce the dependency and the surrounding uncertainty, companies can cultivate connections with external entities that control these resources. Given that all corporations depend on others to survive and thrive, resource dependence theory indicates that managing relationship with external parties is the major task of the board and board of directors should be selected based on their background, expertise, social ties etc.

Overall, the resource dependence theory indicates that 1) corporations depend on others for survival and thrive; 2) board of directors bring value to the firm due to their background, expertise, social connections etc. 3) the major role or responsibility for the board of directors are managing their relationship with external parties; 4) board of directors may come from a network of other powerful people. Thus, this network of powerful people are important assets and resources to the firm. The usually, Academic director have more resource the other independent director, so I have

tested the effect of academic director to firm performance.

2.3 Hypotheses Development

2.3.1 The relationship between the presence of AIDs and firm performance

AIDs can play positive corporate governance role in a firm (Francis, Hasan and Wu, 2015). Firstly, AIDs are specialized professionals in their (research) field and therefore, they can play advising role more effectively through utilizing knowledge they possess relative to firms without AIDs. Audretsch and Lehmann (2006) argue that directors with academic background may enhance firm's competitive advantage through accessing to and the absorption of external knowledge spillover. Thus, AIDs can increase firm performance by bringing valuable advice to the firm. Secondly, board diversity can increase firm performance (Carter, Simkins, and Simpson, 2003; Adams and Ferreira, 2009; Anderson et al., 2011; Gul, Srinidhi, and Ng, 2011). AIDs can increase board diversity through adding academic professors sitting on the board. Forbes and Milliken (1999) argue that job-related diversity, such as academic professors sitting on the board as independent directors, may broaden the skills on the board. Thirdly, academic professors care more about their reputations, whereby they can play monitoring role more effectively relative to firms without AIDs. This is particularly true in countries with Confucius culture background, like China, as people in these countries show profound/high/great respect to teachers. Under the institutional background of China, the motivation for the independent directors to perform their duties is to avoid reputational and legal risks (Qingquan T et al., 2006; Kangtao Y et al., 2011). From the perspective of reputational risk, the independent director system of listed Chinese companies is mainly comprised by prominent figures in education or business fields. These people

are usually very successful in their own areas of focus, which means that they also hold relativity high social status and good reputation in their respective industry. More than 76% firms have at least one academic professor as non-executive director in China. Overall, these arguments suggest that AIDs are beneficial to the firm they serve and can increase firm performance as well.

Alternatively, AIDs might have no impact on firm performance. Firstly, academic directors might have not enough time on playing advising and monitoring role due to their busy work in research and teaching in universities their serve. Secondly, AIDs are nominated by members of nomination committee and appointed by shareholders. The effectiveness of monitoring of AIDs is reduced and limited if firms are controlled by controlling shareholders as essentially AIDs are appointed by controlling shareholders and represent the interest of controlling shareholders rather than minority shareholders. This might be the case in this study as many Chinese listed companies are controlled by large controlling shareholders. Thirdly, AIDs cannot play an effective monitoring role as they receive their service fees from companies they serve. As the Bible says "You shall not take gift, for gift blinds the wise, and perverts the words of the righteous"[1] (Exodus, 23:8). Overall, AIDs cannot play effective corporate governance role and have no impact on firm performance. Therefore, based on the above discussion, I come up with the following hypotheses.

H1-0: There is no association between AIDs and firm performance

H1-1: There is a positive association between AIDs and firm performance

As exposited in the introduction, I examine the relationship between AIDs and firm performance

[1] Some English proverbs express the similar meanings, such as "Gifts blind the eyes of the wise".

using pooled OLS regression model (Gormley and Matsa 2014). We will elaborate on the methodologies in chapter 2.5.1.

2.3.2 The relationship between the number of AIDs and firm performance.

Token status theory argue that female or minorities in top management team are regarded as "tokens" and the images of female token managers are more linked to femininity rather than to the qualities of leadership (Kanter, 1977; Liu, Wei and Xie, 2014). I borrow the same idea from token status theory in female managers and use them in AIDs. I argue that the impact of AIDs on firm decisions and performance might be limited because a solitary AID is seen as a mere "token" by both external and internal stakeholders. Thus, firms with only one academic professor sitting on the board as independent directors might not perform better.

As an extension of the token status theory, the critical mass theory argues that "one is a token, two is a presence, and three is a voice" (Kristie, 2011). This critical mass theory suggests that firms with more AIDs perform better as more AIDs can voice their opinions compared to firms with less AIDs. Therefore, based on this discussion, I propose the following hypothesis.

H2-0: There is no association between the number of AIDs and firm performance.

H2-1: There is a positive association between the number of AIDs and firm performance.

As exposited in the introduction, I examine the relationship between the number of AIDs and firm performance using pooled OLS regression model (Gormley and Matsa 2014). We will elaborate on the methodologies in chapter 2.5.2.

2.3.3 The relationship between school affiliation of AIDs and firm performance

School affiliation of academic director might have impact on firm performance. Firstly, AIDs from top university care more about their reputations and thus they can play monitoring role more effective. Secondly, AIDs from top universities are more specialized professional in their research field. Therefore, they can enhance firm performance by bringing valuable advice to the firms. On the other hand, AIDs from top university might have no impact on firm performance as they have fewer time on firm's advice and monitor role due to their busier work in top universities. Therefore, I propose the following hypotheses.

H3-0: There is no association between school affiliation of AIDs and firm performance.

H3-1: There is a positive association between school affiliation of AIDs and firm performance.

As exposited in the introduction, I examine the relationship between school affiliation of AIDs and firm performance using pooled OLS regression model (Gormley and Matsa 2014). We will elaborate on the methodologies in chapter 2.5.3.

2.3.4 The relationship between AIDs with administrative role and firm performance

The relationship between AIDs and firm performance might depend on whether AIDs with administrative role or not (Francis, Hasan and Wu, 2015). On the one hand, based on resource dependence theory, AIDs with administrative role have a wider social network and are more likely to bring more valuable resources to the firm and thereby enhance firm performance. Moreover, AIDs with administrative have strong leadership and are capable of working with a complicated

group. This leadership and working experience can enhance the efficiency of work in a large board. Therefore, AIDs with administrative positions sitting on the board can increase firm performance. Alternatively, AIDs with administrative positions in their university might have no influence on firm performance. Firstly, academic directors with administrative positions might have no enough time in playing a monitor role or advising role due to their busy work. Prior studies find that busier directors are less effective (Fich and Shivdasani, 2006; Adams, Hermalin, and Weisbach, 2008). Secondly, AIDs with administrative positions may be less independent relative to those without administrative positions. For example, AIDs with university president position are less independent and do not have strong incentive to play monitoring role if the firm they serve denotes some money to the university. Cho, Jung, Kwak, Lee, and Yoo (JBE2017) investigate the positive association weakens when AIDs hold an administrative position at their universities. Based on the above discussion, I propose the following hypotheses:

H4-0: There is no association between AIDs with administrative position and firm performance.

H4-1: There is a positive association between AIDs with administrative position and firm performance.

As exposited in the introduction, I examine the relationship between AIDs with administrative position and firm performance using pooled OLS regression model (Gormley and Matsa 2014). We will elaborate on the methodologies in chapter 2.5.4.

2.3.5 The relationship between academic positions of AIDs and firm performance.

Academic position of AIDs might have impact on firm performance as AIDs with senior academic positions are better in subject expertise and have more social resources. Francis, Hasan and Wu (2015) investigate whether academic directors having professor academic position have impact on firm performance. They find that firms with academic directors having professors perform better compared to firms without. The possible reasons include that professors care more about their reputation and are more independent. Thus, they can play effective monitoring role. In addition, professors are expert in their research area, and they can bring more value resources to the firm. In other words, they can play advising role more effectively.

Alternatively, academic position of AIDs might have no influence on firm performance. Firstly, normally, senior academic position such as professors suggests that the person is doing very well in his or her area. But this does not mean that specific area is beneficial to the firm they serve as independent directors. For example, professors in accounting and finance as independent directors might be beneficial to the firm in terms of corporate governance, auditing, or corporate finance area. However, professors in art as independent directors might not beneficial to a firm. Secondly, senior academic position in one university does not mean he or she can hold the same academic position in better universities. Thus, AIDs with high academic position does not mean they can bring more value to the firm they serve as independent directors. For example, a professor working for non-ivy league universities in US does not mean that he or she can hold a same professorship in ivy league universities (Normally, the quality of professors working for ivy league universities is better than the quality of professors working for non-ivy league universities on average, but not the always the case). Therefore, I come up with the following hypothesis.

H5-0: There is no association between AIDs with senior academic position and firm performance.

H5-1: There is a positive association between AIDs with senior academic position and firm performance.

As exposited in the introduction, I examine the relationship between AIDs with senior academic position and firm performance using pooled OLS regression model (Gormley and Matsa 2014). We will elaborate on the methodologies in chapter 2.5.5.

2.3.6 The relationship between AIDs with various subject expertise and firm performance.

The relationship between AIDs and firm performance might depend on the subject background of AIDs. Based on subject background of academic directors, Francis, Hasan and Wu (2015) classify the academic directors into several groups including education, technology, business-related, law, medicine, political science, and others. They find that different subject backgrounds have different impacts on firm performance. In particular, academic directors with business-related degrees, technology degrees, and political degrees have positive effect on firm performance, while academic directors with law, education, and medical degrees have no impact on firm performance. They argue that the better performance of firms with business-related degrees and technology degrees is consistent with the advising role played by academic directors. The better performance of firms with political degrees is consistent with the argument that firms select academic professors with political degrees because they want to reduce litigation risk. Cho, et, al (JBE2017) found that firms with AIDs have higher CSR performance ratings than those without. In addition, the

influence of AIDs on CSR rating depends on their academic background. In particular, the positive association between AIDs and CSR rating is significant only when their academic background is science, engineering, or medicine.

In this study, I divide AIDs with various subject expertise into four groups including AIDs with business-related background (e.g., the subject expertise of academic director is economic, finance or accounting etc.), law background, science and engineering background, and art background. I use this category to test whether the AIDs with various subject expertise affect firm performance. The academic directors with business-related background might provide best business practices in playing a monitoring role or advisory role on board. Firms might have the best legal compliance when having academic directors with law background sitting on the board. In addition, professors with science and engineering background may play an effective role in advising rather than monitoring role. AIDs with art background might not play either monitoring role or advising role effectively. Therefore, I propose the following hypotheses.

H6-0: There is no association between AIDs with art background and firm performance;

H6-1: There is a positive association between AIDs with business, or law or science and engineering background and firm performance.

As exposited in the introduction, I examine the relationship between AIDs with different background and firm performance using pooled OLS regression model (Gormley and Matsa 2014). We will elaborate on the methodologies in chapter 2.5.6.

2.4 Data and Methodology

2.4.1 Data Selection Process and Sample Characteristics

We create an Academic Independent Director Database based on information from CSMAR. To construct this academic director database, I first download data about profiles of directors, supervisors and senior managers from CSMAR database. The total number of observations is 699,221. Based on profile information, I search records with the following fields as professor including assistant professor, associate professor and full professor, dean or head of school, (senior) research fellow, head of research institute, administer of research, VC (vice chancellor) or president of university, director, visiting scholar, supervisors, lecturer including assistant lecturer, lecturer, senior lectures. teacher. The total number of observations is 226,923. I focus on listed firms listed on main board and exclude firms listed on Small and Medium size board and ChiNext board. In addition, I exclude financial institutions. The total number of observation left is 147, 035. Since some academic professors are sitting on several board as non-executive directors and I only keep one record for each academic director in the database. The total number of observations is 35,453. I further delete records with directors, visiting professors, supervisor, and division chief. The total number of observations is 11,043. In addition, I further delete records with professor-level senior engineers, affiliated professors, and honorary professors. I only focus on academic professors with full-time employed at university or institute. The total number of observation left is 3,923. Finally, I only focus on academic directors sitting on the board of directors rather than supervisory board and senior management team. The total number of observations left is 3,815.

In addition, I use data including ownership structure, corporate governance, firm characteristics and financial data. The data source also comes from the CSMAR database developed by the Shenzhen GTA Information Technology Co. This study focuses on all listed companies listed on Shanghai Stock Exchange and Shenzhen Stock Exchange excluding companies listed on SME (i.e., Small and Medium Enterprises) and ChiNext board. All financial companies and utility companies are dropped as their business models are different from other companies. I also delete the firm-year observation with missing values. In addition, to avoid being affected by outliers, all variables are winsorized at 1% and 99%. In the end, I obtain 16815, 16815 firm-year observations from 2004-2016.

Table 2.4.1(1): The distribution of AIDs in Chinese listed companies between year 2004 to 2016.

Panel A: By Year

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Number	1535	1649	1657	1655	1722	1733	1739	1806	1906	1955	2148	2237	2312	24054
Percentage	6.38%	6.86%	6.89%	6.88%	7.16%	7.20%	7.23%	7.51%	7.92%	8.13%	8.93%	9.29%	9.61%	100%

Panel B: By Title

	Presidents	Vicepresid	Chairman	Deans	Director of Institute	Divisionhe	Professor	NAE	Lecture	Phd_s	Research Fellow	Teacher	Total
Number	425	1186	7260	8101	1486	399	20813	2284	28	15555	1048	94	58679
Percentage	0.72%	2.02%	12.37%	13.80%	2.53%	0.67%	35.46%	3.89%	0.05%	26.51%	1.79%	0.16%	100%

Panel C: By Major

	Efa	Law	Sci	Art	Total
Number	17261	2527	4007	259	24054
Percentage	71.76%	10.51%	16.66%	1.08%	100%

Panel D: By School

	985	211	No985/211	Total
Number	11529	5714	6811	24054
Percentage	47.93%	23.75%	28.32%	100%

Table 2.4.1(2). Variables Explanation

Variable	Definition
Dependent Variable	
TQ	indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets.
Independent Variables	
DUM_AID	a dummy variable that is equal to one if a firm has at least one academic independent director, and zero otherwise.
AID Ratio	represents the percent of academic independent directors on board.
D1_AID	a dummy variable, equals to one when the board has one academic director sitting in the board, and zero otherwise.
D2_AID	a dummy variable, equals to one when the board has two academic directors sitting in the board, and zero otherwise.
D3_AID	a dummy variable, equals to one when the board has three academic directors sitting in the board, and zero otherwise.
DUM_985	a dummy variable that is equal to one if a firm has at least one AIDs from 985 group university, and zero otherwise
DUM_211	a dummy variable that is equal to one if a firm has at least one AIDs from 211 group university, and zero otherwise.
DUM_No985/211	a dummy variable that is equal to one if a firm has at least one academic director from out of 985 and 211 groups university, and zero otherwise.
DUM_PRES	a dummy variable that is equal to one if a firm has at least one AIDs is president sitting in the board, and zero otherwise.
DUM_VPRES	a dummy variable that is equal to one if a firm has at least one AIDs is Vic president sitting in the board, and zero otherwise.
DUM_Chairman	a dummy variable that is equal to one if a firm has at least one AIDs is chairman sitting in the board, and zero otherwise.
DUM_Dean	a dummy variable that is equal to one if a firm has at least one AIDs is deans sitting in the board, and zero otherwise.
DUM_DOI	a dummy variable that is equal to one if a firm has at least one AIDs is director of the institute sitting in the board, and zero otherwise.
DUM_Division	a dummy variable that is equal to one if a firm has at least one AIDs has division chief sitting in the board, and zero otherwise.
DUM_Administer	a dummy variable that is equal to one if a firm has at least one AIDs with administered position sitting in the board, and zero otherwise.
DUM_Professor	a dummy variable that is equal to one if a firm has at least one AIDs is professor in the board, and zero otherwise.
DUM_AssoProf	a dummy variable that is equal to one if a firm has at least one AIDs is ass-professor sitting in the board, and zero otherwise.
DUM_PhD Supervisor	a dummy variable that is equal to one if a firm has at least one AIDs is supervisor for PhD sitting in the board, and zero otherwise.
DUM_Researcher	a dummy variable that is equal to one if a firm has at least one AIDs is research fellow sitting in the board, and zero otherwise.
DUM_EFA	a dummy variable that is equal to one if a firm has at least one AID come from

	economic, finance or accounting school, and zero otherwise.
DUM_LAW	a dummy variable that is equal to one if a firm has at least one AID come from law school, and zero otherwise.
DUM_SCI	a dummy variable that is equal to one if a firm has at least one AID come from science school, and zero otherwise.
DUM_ART	a dummy variable that is equal to one if a firm has at least one AID come from arts school, and zero otherwise.
DUM_NAE	a dummy variable that is equal to one if a firm has at least one AID is NAE sitting in the board, and zero otherwise.
Treated	a dummy variable that is equal to one if a firm has at least one AID prior to the introduction of the Regulation 11 (treated group) and equals to zero is this not the case (control group).
Post	a dummy variable a dummy variable that is equal to one in the year after Regulation 11(after 2015) and 0 in the years preceding its introduction (before 2015).
P*T	indicates Pose multiply by Treated.
Control Variables	
FS	indicates nature log of firm size which is defined as total assets.
LEV	indicates leverage which is defined as the ratio of total long-term liabilities to total assets.
TANG	indicates tangibility which is defined as the ratio of fixed assets to total assets.
GROWTH	indicates sales growth which is defined as the percentage change in sales year-on-year.
CAPEX	indicates capital expenditure defined as the total capital expenditure divided by total assets.
BS	indicates board size which is defined as the total number of directors on the board.
INDE	indicates the ratio of independent director sitting in board.
INVST	indicates the investment of firms.
AGE	indicates the age of firms.
NFA	indicates net fixed assets of firms.

Table 2.4.1(3). Summary Statistics

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_AID** is a dummy variable that is equal to one if a firm has at least one academic independent director, and zero otherwise. **AID Ratio** represents the percent of academic independent directors on board. **D1_AD** is a dummy variable, equals to one when the board has one academic director sitting in the board, and zero otherwise. **D2_AD** is a dummy variable, equals to one when the board has two academic directors sitting in the board, and zero otherwise. **D3_AD** is a dummy variable, equals to one when the board has three academic directors sitting in the board, and zero otherwise. **DUM_985** is a dummy variable that is equal to one if a firm has at least one AIDs from 985 group university, and zero otherwise. **DUM_211** is a dummy variable that is equal to one if a firm has at least one AIDs from 211 group university, and zero otherwise. **DUM_No985/211** is a dummy variable that is equal to one if a firm has at least one academic director from out of 985 and 211 groups university, and zero otherwise. **DUM_PRES** is a dummy variable that is equal to one if a firm has at least one AIDs is president sitting in the board, and zero otherwise. **DUM_VPRES**is a dummy variable that is equal to one if a firm has at least one AIDs is Vic president sitting in the board, and zero otherwise. **DUM_Chairman** is a dummy variable that is equal to one if a firm has at least one AIDs is chairman sitting in the board, and zero otherwise. **DUM_Dean** is a dummy variable that is equal to one if a firm has at least one AIDs is deans sitting in the board, and zero otherwise. **DUM_DOI** is a dummy variable that is equal to one if a firm has at least one AIDs is director of the institute sitting in the board, and zero otherwise. **Division** is a dummy variable that is equal to one if a firm has at least one AIDs is division head sitting in the board, and zero otherwise. **DUM_Administer** is a dummy variable that is equal to one if a firm has at least one AIDs with administered position sitting in the board, and zero otherwise. **DUM_Professor** is a dummy variable that is equal to one if a firm has at least one AIDs is professor in the board, and zero otherwise. **DUM_AssoProf**is a dummy variable that is equal to one if a firm has at least one AIDs is ass-professor sitting in the board, and zero otherwise. **DUM_PhD Supervisor**is a dummy variable that is equal to one if a firm has at least one AIDs is supervisor for PhD sitting in the board, and zero otherwise. **DUM_Researcher** is a dummy variable that is equal to one if a firm has at least one AIDs is researcher sitting in the board, and zero otherwise. **DUM_NAE** is a dummy variable that is equal to one if a firm has at least one AID is NAE sitting in the board, and zero otherwise. **DUM_EFA** is a dummy variable that is equal to one if a firm has at least one AID come from economic, finance or accounting school, and zero otherwise. **DUM_LAW** is a dummy variable that is equal to one if a firm has at least one AID come from law school, and zero otherwise. **DUM_SCI** is a dummy variable that is equal to one if a firm has at least one AID come from science school, and zero otherwise. **DUM_ART** is a dummy variable that is equal to one if a firm has at least one AID come from arts school, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

Variable	Obs	Mean	Std. Dev.	Min	Max
Tq01	16,815	1.972781	1.780236	0.6367	12.7658
Tq02	16,815	2.022735	1.812971	0.6791	13.05
Tq03	16,815	1.607512	1.738995	0.1843	12.1255
Tq04	16,815	1.656723	1.766675	0.2311	12.337
Tq05	16,815	2.003357	1.824499	0.6627	13.33
Tq06	16,815	2.05211	1.850052	0.707	13.4916
DUM_AID	16,815	0.7577758	0.428442	0	1
D1_AD	16,815	0.320785	0.4667922	0	1
D2_AD	16,815	0.2635147	0.4405522	0	1
D3_AD	16,815	0.1734761	0.3786696	0	1
AID Ratio	16,815	0.1572045	0.1281252	0	0.8571429
DUM_NO985/211	16,815	0.6249182	0.4841584	0	1
DUM_985	16,815	0.478204	0.4995396	0	1
DUM_211	16,815	0.2808207	0.4494134	0	1
DUM_Administer	16,815	0.6207553	0.4852135	0	1
DUM_PRES	16,815	0.0242046	0.1536884	0	1
V President	16,815	0.066964	0.2499671	0	1
DUM_Chairman	16,815	0.3493904	0.4767916	0	1
DUM_Dean	16,815	0.3748439	0.484097	0	1
DUM_DOI	16,815	0.0838537	0.2771765	0	1
DUM_Division	16,815	0.0233125	0.1508986	0	1
DUM_Professor	16,815	0.6980672	0.4591099	0	1
DUM_AssoProf	16,815	0.1253643	0.3311413	0	1
DUM_PhD Supervisor	16,815	0.5818614	0.4932679	0	1
DUM_Researcher	16,815	0.0588165	0.235288	0	1
DUM_EFA	16,815	0.6580434	0.4743792	0	1
DUM_LAW	16,815	0.1437407	0.3508371	0	1

DUM_SCI	16,815	0.1985132	0.3988925	0	1
DUM_ART	16,815	.0148082	.1207882	0	1
DUM_NAE	16,815	0.0279512	0.164838	0	1
FS	16,815	21.98511	1.390357	18.78401	25.93746
Leverage	16,815	0.5390341	0.2446105	0.07949	1.73615
Tan	16,815	0.2724496	0.1931861	0	0.78
Growth	16,815	0.2311031	0.7992419	-0.7255	6.2267
Capex	16,815	0.0494345	0.0515514	0.00007	0.24924
BS	16,815	9.200595	1.923764	5	15
Independent	16,815	0.3636617	0.0543853	0	0.8

2.4.2 Methodology

2.4.2.1 The relationship between academic directors and firm performance

The main method used to test the relationship between academic directors and firm performance is panel data fixed effect. To ensure robustness of our findings, I follow the Gormley and Matsa (2014) and carry out OLS regression with industry and year fixed effects. The model specification is as follows

$$TQ_{i,t} = \beta_0 + \beta_1 Academic_{i,t} + \beta_2 Independence_{i,t} + \beta_3 BoardSize_{i,t} + \beta_4 FirmSize_{i,t} + \beta_5 Leverage_{i,t} + \beta_6 Growth_{i,t} + \beta_7 Capex_{i,t} + \beta_7 Tangitabal_{i,t} + f_s + \mu_i + \delta_t + \varepsilon_{i,t}$$

Model 1

Dependent and Independent Variables:

FIRM_PERFORMANCE is measured by Tobin's Q. Tobin's Q which is defined as market value of total assets divided by book value of total assets. The book value of total assets is obtained from the balance sheet, while the market value of total assets is the sum of the market value of total equity plus the market value of total debt. However, there is either no market of debt or no liquid market of debt, hence there is no market value of total debt. Following the previous literature about calculating Tobin's Q, I use the book value of total debt as the proxy of market value of the total debt. Regarding the market value of total equity, given that there were/are tradable shares and non-tradable shares in listed companies in China, the market value of tradable

shares is equal to the product of the market price of tradable shares and the total number of tradable shares. Regarding the market value of non-tradable shares, I use the following methods to calculate market value of non-tradable shares: 1) using the 20% of tradable shares as the proxy of market price of corresponding non-tradable shares, the corresponding Tobin's Q is referred as **TQ_01**; 2) using the 30% of tradable shares as the proxy of market price of corresponding non-tradable shares, the corresponding Tobin's Q is referred as **TQ_02,** 3) using the net asset value per share as the proxy of market value of corresponding non-tradable shares, the corresponding Tobin's Q is referred as **TQ_03 and TQ_04**; 4) using the market price of tradable shares as the proxy of market price of corresponding non-tradable shares, the corresponding Tobin's Q is referred as **TQ_05 and TQ_06**. Using 20% and 30% of tradable shares as the proxy of market price pf corresponding non-tradable shares are due to the illiquidity discount (e.g., Cai, Hillier and Wang, 2015). In addition, I also use the net asset value per share as another proxy due to illiquidity discount (net asset value per share can be obtained directly from balance sheet). Finally, I use the market price of tradable shares as the proxy of market price of non-tradable shares.

The key independent variable is $Academic$ and $AcademicRatio$. $Academic$ is a dummy variable and it takes one if a firm has at least one AID sitting on the board and zero otherwise. $AcademicRatio$ is the ratio of AIDs sitting on the board to the board size.

Control Variables:

Independence is the percentage of independent directors (excluding academic directors) on the board. *Board Size* is the natural log of the total number of directors. *Firm Size* is the natural log of the

firm's total assets. *Leverage* is the book value of debt over the total assets. *Tangitable* indicates tangibility which is defined as the ratio of fixed assets to total assets. *Growth* indicates sales growth which is defined as the percentage change in sales year-on-year. *Capex* indicates capital expenditure defined as the total capital expenditure divided by total assets.

2.5 Empirical Analysis

2.5.1 The Relationship between the presence of AIDs and firm performance.

In this section, I test the relationship between AIDs and firm performance. Particularly, I focus on whether firms have AIDs sitting on the board. Under the institutional background of China, the motivation for the independent directors to perform their duties is to avoid reputational and legal risks (Qingquan T et al., 2006; Kangtao Y et al., 2011). From the perspective of reputational risk, the independent director system of listed Chinese companies is mainly comprised by prominent figures in education or business fields. These people are usually very successful in their own areas of focus, which means that they also hold relativity high social status and good reputation in their respective industry. As an elite social group, they attach great importance to their personal reputation (Qingquan T et al., 2006). Under such circumstances, when major legal or operational problem emerge in the company where the independent director performs his/her duty, the social reputation of the director himself/herself would also be severely undermined. Existing empirical studies have shown that reputational incentive is the main mechanism for the performance of governance function by the independent directors in listed Chinese companies (Fan Zhou et al., 2008; Yan Li et al., 2011).

Table 2.5.1 shows that the coefficients of DUM_AID is significant and negative across various models. The results indicate that firms having AIDs do not perform better than firms without. They actually perform worse than firms without AIDs sitting on the board. These results are not consistent with previous studies. The possible reasons might be: Firstly, academic directors might have no enough time on playing advising and monitoring role due to their busy work in research and teaching in universities their serve. Secondly, AIDs are nominated by members of nomination committee and appointed by shareholders. The effectiveness of monitoring of AIDs is reduced and limited if firms are controlled by controlling shareholders as essentially AIDs are appointed by controlling shareholders and represent the interest of controlling shareholders rather than minority shareholders. This might be the case in this study as many Chinese listed companies are controlled by large controlling shareholders. Thirdly, AIDs cannot play an effective monitoring role as they receive their service fees from companies they serve. As the Bible says, "You shall not take gift, for gift blinds the wise, and perverts the words of the righteous" (Exodus, 23:8). Overall, AIDs cannot play effective corporate governance role and have no impact on firm performance.The coefficients of most control variables are consistent with the expectation. Small firms perform better because they have more investment opportunities. Firms with high leverage perform better because of the tax shield benefits. Higher growth firms perform better because there are more growth opportunities. Firm with more capital expenditure performance better because more investment has been taken and eventually this will be transformed to enhance firm performance. Firm with higher independent directors perform better as that will reduce the agency cost. Previous literature document that small board perform better. They argue that this is because the communication cost is large in large board. However, in this study I find that large board

perform better. The possible reason is that the more external resources can be brought into the firm and that will increase firm performance.

Table 2.5.1: The relationship between the presence of AIDs and firm performance (OLS)

TQ01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_AID** is a dummy variable that is equal to one if a firm has at least one academic independent director, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

Independent Variable	**TQ01**	**TQ02**	**TQ03**	**TQ04**	**TQ05**	**TQ06**
DUM_AID	-0.060**	-0.064**	-0.070***	-0.072***	-0.066**	-0.068**
	(0.026)	(0.027)	(0.026)	(0.027)	(0.027)	(0.028)
FS	-0.775***	-0.794***	-0.748***	-0.766***	-0.785***	-0.802***
	(0.016)	(0.017)	(0.016)	(0.016)	(0.017)	(0.017)
Leverage	1.081***	1.072***	0.979***	0.964***	1.119***	1.099***
	(0.092)	(0.094)	(0.090)	(0.091)	(0.097)	(0.098)
Tan	-0.552***	-0.574***	-0.100	-0.120	-0.575***	-0.594***
	(0.073)	(0.075)	(0.072)	(0.073)	(0.076)	(0.077)
Growth	0.035*	0.048**	0.035*	0.048**	0.034*	0.047**
	(0.019)	(0.020)	(0.019)	(0.020)	(0.020)	(0.020)
Capex	1.778***	1.880***	1.993***	2.091***	1.784***	1.875***
	(0.225)	(0.230)	(0.220)	(0.224)	(0.234)	(0.237)
BS	0.040***	0.041***	0.038***	0.039***	0.042***	0.043***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Independent	1.993***	2.057***	1.915***	1.973***	2.108***	2.160***
	(0.233)	(0.238)	(0.230)	(0.234)	(0.241)	(0.245)
Year Dummy	YES	YES	YES	YES	YES	YES
Industry Dummy	YES	YES	YES	YES	YES	YES
Constant	15.869***	16.300***	14.944***	15.348***	16.013***	16.397***
	(0.308)	(0.314)	(0.304)	(0.308)	(0.321)	(0.324)
Observations	16,815	16,815	16,815	16,815	16,815	16,815
R-squared	0.423	0.423	0.409	0.411	0.414	0.416
Adj. R-squared	0.422	0.422	0.408	0.409	0.413	0.414
Standard Errors	1.354	1.378	1.338	1.358	1.398	1.416

2.5.2 The Relationship between the number of AIDs and Firm Performance

In this section, I test the relationship between the number of AIDs and firm performance. Based on token status theory, firms with only one academic professor sitting on the board as independent directors might not perform better. Based on critical mass theory, firms with three and more AIDs perform better.

Table 2.5.2 shows that the coefficients of D1_AID and D2_AID are significant and negative across various models. The results indicate that firms having one or two AIDs sitting on the board do not perform better. They actually perform worse compared to firms without one or two AIDs sitting on the board. In addition, the coefficient of D3_AID is positive, although it is not significant. These results are not consistent with critical mass theory as the coefficient of D3_AID is not significant. Overall, the results are closer to token status theory, which indicates that the AIDs do not play corporate governance role.

Compared with researches based on developed market economies such as Britain and the US, efforts targeted at identifying the governing function of independent directors in listed Chinese companies would probably face severer endogenous problems. Unlike European and American companies with decentralized shareholding structure, the ownership structure of listed Chinese companies is characterized by the highly centralized shareholding system, which puts the company under the control of one or a few owners. In addition, the Chinese legal system has provided relatively weak protection for the investors. The major shareholders are able to make sizeable personal gains through their controlling right over the company. As a result, they have strong incentives to infringe upon the interests of small and medium shareholders through capital appropriation, related-party transactions, inter-company loans, etc. (Zengquan Li et al., 2004; Jian

and Wong, 2010; Jiang et al., 2010). For such companies, the core issue of corporate governance is to protect the interests of small and medium shareholders from the infringing act of major shareholders and the management under their control (Shleifer and Vishny, 1997; Johnson et al., 2000; Berkman et al., 2010). Sometime, there are three AIDs sitting on the board is not enough. Therefore, government regulatory authorities must probe deeper into further improving the independent director system, such as promoting the professionalization of independent directors, including setting position-related thresholds, building an education system, establishing assessment mechanism, and building industry associations for independent directors. Therefore, government regulatory authorities must probe deeper into further improving the independent director system, such as promoting the professionalization of independent directors, including setting position-related thresholds, building an education system, establishing assessment mechanism, and building industry associations for independent directors.

The coefficients on most control variables are consistent with the expectation. Small firms perform better because they have more investment opportunities. Firms with high leverage perform better because of the tax shield benefits. Higher growth firms perform better because there are more growth opportunities. Firm with more capital expenditure performance better because more investment has been taken and eventually this will be transformed to enhance firm performance. Firm with higher independent directors perform better as that will reduce the agency cost. Previous literature document that small board perform better. They argue that this is because the communication cost is large in large board. However, in this study I find that large board perform better. The possible reason is that the more external resources can be brought into the firm and that will increase firm performance.

Table 2.5.2 The relationship between the number of AIDs and firm performance (OLS)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **D1_AD** is a dummy variable, equals to one when the board has one academic director sitting in the board, and zero otherwise. **D2_AD** is a dummy variable, equals to one when the board has two academic directors sitting in the board, and zero otherwise. **D3_AD** is a dummy variable, equals to one when the board has three academic directors sitting in the board, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

Independent Variable	**TQ01**	**TQ02**	**TQ03**	**TQ04**	**TQ05**	**TQ06**
D1_AD	-0.098***	-0.101***	-0.102***	-0.105***	-0.099***	-0.101***
	(0.029)	(0.030)	(0.029)	(0.030)	(0.030)	(0.031)
D2_AD	-0.068**	-0.070**	-0.079***	-0.081***	-0.074**	-0.076**
	(0.030)	(0.031)	(0.030)	(0.030)	(0.031)	(0.032)
D3_AD	0.033	0.029	0.018	0.013	0.022	0.018
	(0.036)	(0.037)	(0.036)	(0.037)	(0.038)	(0.038)
FS	-0.775***	-0.795***	-0.749***	-0.767***	-0.786***	-0.803***
	(0.016)	(0.017)	(0.016)	(0.016)	(0.017)	(0.017)
Leverage	1.079***	1.071***	0.977***	0.963***	1.118***	1.098***
	(0.092)	(0.094)	(0.090)	(0.091)	(0.097)	(0.098)
Tan	-0.546***	-0.568***	-0.095	-0.114	-0.569***	-0.588***
	(0.073)	(0.075)	(0.071)	(0.073)	(0.076)	(0.077)
Growth	0.036*	0.049**	0.036*	0.049**	0.035*	0.048**
	(0.019)	(0.020)	(0.019)	(0.020)	(0.020)	(0.020)
Capex	1.771***	1.873***	1.985***	2.084***	1.777***	1.868***
	(0.225)	(0.230)	(0.220)	(0.224)	(0.234)	(0.237)
BS	0.035***	0.036***	0.033***	0.035***	0.038***	0.039***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Independent	1.910***	1.975***	1.838***	1.897***	2.031***	2.084***
	(0.233)	(0.238)	(0.230)	(0.234)	(0.242)	(0.246)
Year Dummy	YES	YES	YES	YES	YES	YES
Industry Dummy	YES	YES	YES	YES	YES	YES
Constant	15.946***	16.376***	15.015***	15.418***	16.084***	16.466***
	(0.310)	(0.315)	(0.306)	(0.310)	(0.322)	(0.326)
Observations	16,815	16,815	16,815	16,815	16,815	16,815
R-squared	0.423	0.424	0.410	0.411	0.415	0.416
Adj. R-squared	0.422	0.423	0.408	0.410	0.413	0.415

2.5.3 The Relationship between school affiliation of AIDs and Firm Performance

In this section, I test the relationship between school affiliation of AIDs and firm performance. I classify the AIDs into three categories based on their affiliation of universities they serve. They are AIDs from group 985, AIDs from group 211, and AIDs from group non985&211 universities. Group 985 universities are top universities in China, and they are equivalent or similar to G5 in UK. Group 211 universities in China are second tier top universities in China and they are equivalent or similar to Russel group universities in UK. The rest universities are referred as non985&211 universities.

Table 2.5.3 shows that the coefficients of DUM_985, DUM_211, and DUM_NO985&211 are not significant across various models. The results indicate that school affiliation of AIDs has no association with firm performance.

The coefficients on most control variables are consistent with the expectation. Small firms perform better because they have more investment opportunities. Firms with high leverage perform better because of the tax shield benefits. Higher growth firms perform better because there are more growth opportunities. Firm with more capital expenditure performance better because more investment has been taken and eventually this will be transformed to enhance firm performance. Firm with higher independent directors perform better as that will reduce the agency cost. Previous literature document that small board perform better. They argue that this is because the communication cost is large in large board. However, in this study I find that large board perform better. The possible reason is that the more external resources can be brought into the firm and that will increase firm performance.

Table 2.5.3 The Relationship Between School Affiliation of AIDs and Firm Performance (OLS)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_985** is a dummy variable that is equal to one if a firm has at least one AIDs from 985 group university, and zero otherwise. **DUM_211** is a dummy variable that is equal to one if a firm has at least one AIDs from 211 group university, and zero otherwise. **DUM_No985/211** is a dummy variable that is equal to one if a firm has at least one academic director from out of 985 and 211 groups university, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

	(1)	(2)	(3)
VARIABLES	Model	Model	Model
DUM_985	0.032		
	(0.021)		
DUM_211		-0.019	
		(0.022)	
DUM_NO985&211			0.000
			(0.022)
FS	-0.776***	-0.775***	-0.775***
	(0.016)	(0.016)	(0.016)
Leverage	1.088***	1.086***	1.086***
	(0.092)	(0.092)	(0.092)
Tan	-0.543***	-0.549***	-0.549***
	(0.073)	(0.073)	(0.073)
Growth	0.035*	0.035*	0.035*
	(0.019)	(0.019)	(0.019)
Capex	1.788***	1.786***	1.785***
	(0.225)	(0.225)	(0.225)
BS	0.037***	0.039***	0.038***
	(0.006)	(0.006)	(0.006)
Independent	1.950***	1.973***	1.968***
	(0.233)	(0.232)	(0.233)
Year Dummy	YES	YES	YES
Industry Dummy	YES	YES	YES
Constant	15.882***	15.855***	15.861***
	(0.309)	(0.308)	(0.308)
Observations	16,815	16,815	16,815
R-squared	0.423	0.423	0.423
Adj. R-squared	0.422	0.421	0.421
Standard Errors	1.354	1.354	1.353

2.5.4 The Relationship between administrative position of AIDs and Firm Performance

In this section, I test the relationship between AIDs with administrative positions and firm performance. I classify the AIDs into seven categories based on their administrative positions. They are AIDs with administrative position of university president, AIDs with administrative position of university vice-president, AIDs with administrative of Chairman, AIDs with administrative position of dean (i.e., school head), AIDs with administrative of director of the institute, AIDs with administrative of department head (i.e., division head), AIDs with administrative of administrator.

Table 2.5.4 shows that the coefficients on the variables are not significant across various models except the coefficient on the variables of DUM_PRESIDENT. The results indicate that only firms with AIDs with administrative position of university president perform better. On the one hand, based on resource dependence theory, AIDs with administrative role have a wider social network and are more likely to bring more valuable resources to the firm and thereby enhance firm performance. Moreover, AIDs with administrative have strong leadership and are capable of working with a complicated group. This leadership and working experience can enhance the efficiency of work in a large board. Therefore, AIDs with administrative positions sitting on the board can increase firm performance.

The coefficients on most control variables are consistent with the expectation. Small firms perform better because they have more investment opportunities. Firms with high leverage perform better because of the tax shield benefits. Higher growth firms perform better because there are more growth opportunities. Firm with more capital expenditure performance better because more

investment has been taken and eventually this will be transformed to enhance firm performance. Firm with higher independent directors perform better as that will reduce the agency cost. Previous literature document that small board perform better. They argue that this is because the communication cost is large in large board. However, in this study I find that large board perform better. The possible reason is that the more external resources can be brought into the firm and that will increase firm performance.

Table 2.5.4 The Relationship between Administration Position and Firm Performance (OLS)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_PRES** is a dummy variable that is equal to one if a firm has at least one AIDs is president sitting in the board, and zero otherwise. **DUM_VPRES**is a dummy variable that is equal to one if a firm has at least one AIDs is Vic president sitting in the board, and zero otherwise. **DUM_Chairman** is a dummy variable that is equal to one if a firm has at least one AIDs is chairman sitting in the board, and zero otherwise. **DUM_Dean** is a dummy variable that is equal to one if a firm has at least one AIDs is deans sitting in the board, and zero otherwise. **DUM_DOI** is a dummy variable that is equal to one if a firm has at least one AIDs is director of the institute sitting in the board, and zero otherwise. **DUM_Division** is a dummy variable that is equal to one if a firm has at least one AIDs is division head sitting in the board, and zero otherwise. **DUM_Administer** is a dummy variable that is equal to one if a firm has at least one AIDs with administered position sitting in the board, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

VARIABLES	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model	(7) Model
DUM_PRES	0.263***						
	(0.072)						
DUM_VPRES		0.000					
		(0.032)					
DUM_Chairman			0.019				
			(0.022)				
DUM_Dean				-0.039*			
				(0.021)			
DUM_DOI					0.018		
					(0.037)		
DUM_Division						-0.278***	
						(0.060)	
DUM_Administer							-0.029
							(0.022)
FS	-0.777***	-0.775***	-0.776***	-0.775***	-0.775***	-0.776***	-0.775***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Leverage	1.092***	1.086***	1.086***	1.085***	1.086***	1.082***	1.084***

	(0.092)	(0.092)	(0.092)	(0.092)	(0.092)	(0.092)	(0.092)
Tan	-0.548***	-0.549***	-0.547***	-0.550***	-0.549***	-0.547***	-0.550***
	(0.073)	(0.073)	(0.073)	(0.073)	(0.073)	(0.073)	(0.073)
Growth	0.034*	0.035*	0.035*	0.035*	0.035*	0.035*	0.035*
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Capex	1.798***	1.785***	1.788***	1.784***	1.785***	1.778***	1.782***
	(0.225)	(0.225)	(0.225)	(0.225)	(0.225)	(0.225)	(0.225)
BS	0.037***	0.038***	0.038***	0.039***	0.038***	0.039***	0.039***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Independent	1.942***	1.968***	1.963***	1.982***	1.967***	1.995***	1.982***
	(0.232)	(0.232)	(0.232)	(0.233)	(0.232)	(0.233)	(0.233)
Year Dummy	YES	YES	YES	YES	YES	YES	YES
Industry Dummy	YES	YES	YES	YES	YES	YES	YES
Constant	15.891***	15.861***	15.864***	15.858***	15.862***	15.873***	15.859***
	(0.309)	(0.308)	(0.308)	(0.308)	(0.308)	(0.308)	(0.308)
Observations	16,815	16,815	16,815	16,815	16,815	16,815	16,815
R-squared	0.423	0.423	0.423	0.423	0.423	0.423	0.423
Adj. R-squared	0.422	0.421	0.421	0.422	0.421	0.422	0.422
Standard Errors	1.354	1.354	1.354	1.354	1.354	1.354	

2.5.5 The Relationship between academic positions of AIDs and Firm Performance

In this section, I test the relationship between AIDs with academic positions and firm performance. The data of academic positions of AIDs is manual collected. I divide academic positions into five groups including professor, associate professor, supervisor of PhD, research fellow and NAE (National Academy Engineering). I use this category to test whether the academic positions of AIDs affect firm performance. I argue that AIDs with senior academic positions might play a better advice role due to their professorial expertise and wider social network relative to AIDs with junior academic position.

Table 2.5.5 shows that the coefficients on the variables PhD supervisor, research fellow, and NAE are positive and significant at 1% or 5% significance level. The results indicate that firms with AIDs with academic position of PhD supervisor, research fellow, and NAE perform better compared to other firms without academic position of PhD supervisor, researcher, and NAE. Academic position of AIDs might have impact on firm performance as AIDs with senior academic positions are better in subject expertise and have more social resources. Francis, Hasan and Wu (2015) investigate whether academic directors having professor academic position have impact on firm performance. They find that firms with academic directors having professors perform better compared to firms without. The possible reasons include that professors care more about their reputation and are more independent. Thus, they can play effective monitoring role. In addition, professors are expert in their research area, and they can bring more value resources to the firm. In other words, they can play advising role more effectively.

The coefficients on most control variables are consistent with the expectation. Small firms perform

better because they have more investment opportunities. Firms with high leverage perform better because of the tax shield benefits. Higher growth firms perform better because there are more growth opportunities. Firm with more capital expenditure performance better because more investment has been taken and eventually this will be transformed to enhance firm performance. Firm with higher independent directors perform better as that will reduce the agency cost. Previous literature document that small board perform better. They argue that this is because the communication cost is large in large board. However, in this study I find that large board perform better. The possible reason is that the more external resources can be brought into the firm and that will increase firm performance.

Table 2.5.5 The Relationship between Academic Position and Firm Performance (OLS)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_Professor** is a dummy variable that is equal to one if a firm has at least one AIDs is professor in the board, and zero otherwise. **DUM_AssoProf**is a dummy variable that is equal to one if a firm has at least one AIDs is ass-professor sitting in the board, and zero otherwise. **DUM_PhD Supervisor** is a dummy variable that is equal to one if a firm has at least one AIDs is supervisor for PhD sitting in the board, and zero otherwise. **DUM_Researcher** is a dummy variable that is equal to one if a firm has at least one AIDs is researcher sitting in the board, and zero otherwise. **DUM_NAE** is a dummy variable that is equal to one if a firm has at least one AID is NAE sitting in the board, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Model	Model	Model	Model	Model
DUM_Professor	-0.060**				
	(0.024)				
DUM_AssoProf		-0.050			
		(0.034)			
DUM_PhD Supervisor			0.051**		
			(0.022)		
DUM_Researcher				0.217***	
				(0.051)	
DUM_NAE					0.255***
					(0.065)
FS	-0.774***	-0.776***	-0.777***	-0.775***	-0.777***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Leverage	1.080***	1.087***	1.092***	1.089***	1.091***
	(0.092)	(0.092)	(0.092)	(0.092)	(0.092)
Tan	-0.552***	-0.546***	-0.545***	-0.538***	-0.539***
	(0.073)	(0.073)	(0.073)	(0.073)	(0.073)
Growth	0.035*	0.035*	0.035*	0.035*	0.036*
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Capex	1.778***	1.786***	1.785***	1.765***	1.778***
	(0.225)	(0.225)	(0.225)	(0.225)	(0.225)
BS	0.040***	0.039***	0.036***	0.036***	0.036***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Independent	1.997***	1.977***	1.937***	1.954***	1.949***
	(0.233)	(0.233)	(0.233)	(0.232)	(0.233)
Year Dummy	YES	YES	YES	YES	YES
Industry Dummy	YES	YES	YES	YES	YES
Constant	15.854***	15.877***	15.891***	15.850***	15.906***
	(0.308)	(0.309)	(0.309)	(0.308)	(0.309)
Observations	16,815	16,815	16,815	16,815	16,815

R-squared	0.423	0.423	0.423	0.423	0.423
Adj. R-squared	0.422	0.422	0.422	0.422	0.422
Standard Errors	1.354	1.354	1.354	1.353	1.353

2.5.6 The Relationship between AIDs with various subject expertise and Firm Performance

In this section, I test the relationship between AIDs with various subject expertise and firm performance. The data on various subject expertise of AIDs is manually collected. I divide subject expertise into four categories including economics, finance and accounting (EFA), law (LAW), science (SCI), art (ART). I use this category to test whether AIDs with various subject expertise affect firm performance. AIDs with various subject expertise might or might not have any association with firm performance based on the discussion in hypothesis development section.

Table 4.5.6 shows that the coefficients on the variables EFA, LAW, SCI are not significant and the coefficient on variable ART is even negative and significant at 10% significance level. There results indicate that there is no association between AIDs with various subject expertise and firm performance except the AIDs with art subject expertise.

The coefficients on most control variables are consistent with the expectation. Small firms perform better because they have more investment opportunities. Firms with high leverage perform better because of the tax shield benefits. Higher growth firms perform better because there are more growth opportunities. Firm with more capital expenditure performance better because more investment has been taken and eventually this will be transformed to enhance firm performance. Firm with higher independent directors perform better as that will reduce the agency cost. Previous literature document that small board perform better. They argue that this is because the communication cost is large in large board. However, in this study I find that large board perform

better. The possible reason is that the more external resources can be brought into the firm and that will increase firm performance.

Table 2.5.6 The relationship between the major of academic director and Tobin's Q (OLS)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_EFA** is a dummy variable that is equal to one if a firm has at least one AID come from economic, finance or accounting school, and zero otherwise. **DUM_LAW** is a dummy variable that is equal to one if a firm has at least one AID come from law school, and zero otherwise. **DUM_SCI** is a dummy variable that is equal to one if a firm has at least one AID come from science school, and zero otherwise. **DUM_ART** is a dummy variable that is equal to one if a firm has at least one AID come from arts school, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

	(1)	(2)	(3)	(4)
VARIABLES	Model	Model	Model	Model
DUM_EFA	0.013			
	(0.023)			
DUM_LAW		-0.013		
		(0.029)		
DUM_SCI			-0.017	
			(0.026)	
DUM_ART				-0.135*
				(0.078)
FS	-0.776***	-0.775***	-0.776***	-0.775***
	(0.016)	(0.016)	(0.016)	(0.016)
Leverage	1.087***	1.086***	1.085***	1.084***
	(0.092)	(0.092)	(0.092)	(0.092)
Tan	-0.549***	-0.549***	-0.550***	-0.550***
	(0.073)	(0.073)	(0.073)	(0.073)
Growth	0.035*	0.035*	0.035*	0.035*
	(0.019)	(0.019)	(0.019)	(0.019)
Capex	1.788***	1.785***	1.791***	1.782***
	(0.225)	(0.225)	(0.225)	(0.225)
BS	0.038***	0.038***	0.039***	0.039***
	(0.006)	(0.006)	(0.006)	(0.006)
Independent	1.963***	1.973***	1.976***	1.973***
	(0.233)	(0.232)	(0.233)	(0.232)
Year Dummy	YES	YES	YES	YES
Industry Dummy	YES	YES	YES	YES
Constant	15.863***	15.859***	15.861***	15.862***
	(0.308)	(0.308)	(0.308)	(0.308)
Observations	16,815	16,815	16,815	16,815
R-squared	0.423	0.423	0.423	0.423

Adj. R-squared	0.421	0.421	0.421	0.422
Standard Errors	1.354	1.354	1.354	1.354

2.6 Endogeneity Issue

In this section, I address endogeneity issues. Specifically, I consider (1) endogeneity issue due to time-constant omitted variable; (2) endogeneity issue due to inverse causality.

2.6.1 Endogeneity Issue due to time constant omitted variable (Fixed Effect)

To address endogeneity due to time constant omitted variable, I use Fixed Effect analysis. Table 10 shows that there is no association between the presence of AIDs and firm performance. This results and results in Table 2 both indicate that the existence of AID sitting on the board is not beneficial to the firm. Table 2.6.1(2) shows that there is no association between the number of AIDs sitting on the board and firm performance. These results are similar to the results in Table 5 when using OLS to run regression. Table 2.6.1(3) shows that there is no association between school affiliation of AIDs and firm performance. Firms with AIDs coming from group 211 universities perform even worse compared to firms with AIDs not coming from group 211 universities.

The coefficients in Table 2.6.1(4) on the variables representing administrative post are not significant across various models. These results indicate that there is no association between administrative position of AIDs and firm performance. These results are similar to the results when using OLS to run regression in Table 2.5.4.

Table 14 shows that the coefficients on the variables PhD supervisor and NAE are positive and significant at 5% or 10% significance level. The results indicate that firms with AIDs with academic position of PhD supervisor and NAE perform better compared to other firms without academic

position of PhD supervisor and NAE. The reason might be that the AIDs with these academic positions have more knowledge on their area and have more resource to play advising role as independent directors. The results in Table 2.6.1(5) is similar to the results in Table 2.5.5 when using OLS to run regression.

Table 2.6.1(1) The relationship between the presence of AIDs and firm performance (FIXED EFFECT)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_AID** is a dummy variable that is equal to one if a firm has at least one academic independent director, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Model	Model	Model	Model	Model	Model
DUM_AID	-0.017	-0.016	-0.022	-0.022	-0.016	-0.016
	(0.027)	(0.027)	(0.027)	(0.027)	(0.028)	(0.028)
FS	-1.324***	-1.347***	-1.288***	-1.309***	-1.360***	-1.377***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)
Leverage	1.046***	1.018***	0.940***	0.908***	1.071***	1.033***
	(0.054)	(0.055)	(0.054)	(0.055)	(0.056)	(0.057)
Tan	-0.578***	-0.581***	-0.163*	-0.162*	-0.597***	-0.596***
	(0.086)	(0.087)	(0.085)	(0.086)	(0.088)	(0.089)
Growth	0.055***	0.065***	0.052***	0.062***	0.055***	0.066***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Capex	2.341***	2.427***	2.599***	2.683***	2.411***	2.487***
	(0.209)	(0.212)	(0.207)	(0.210)	(0.215)	(0.217)
BS	0.024***	0.025***	0.025***	0.026***	0.024***	0.025***
	(0.008)	(0.009)	(0.008)	(0.008)	(0.009)	(0.009)
Independent	0.953***	0.950***	0.956***	0.951***	0.989***	0.981***
	(0.225)	(0.228)	(0.223)	(0.226)	(0.231)	(0.234)
Year Dummy	YES	YES	YES	YES	YES	YES
Constant	28.141***	28.702***	26.901***	27.400***	28.890***	29.338***
	(0.355)	(0.361)	(0.352)	(0.356)	(0.365)	(0.369)

Observations	16,815	16,815	16,815	16,815	16,815	16,815
R-squared	0.455	0.451	0.450	0.447	0.451	0.449
Number of stkcd	1,541	1,541	1,541	1,541	1,541	1,541
Adj. R-squared	0.399	0.395	0.393	0.391	0.395	0.392

Table 2.6.1(2) The relationship between the number of AIDs and firm performance (FE)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **D1_AD** is a dummy variable, equals to one when the board has one academic director sitting in the board, and zero otherwise. **D2_AD** is a dummy variable, equals to one when the board has two academic directors sitting in the board, and zero otherwise. **D3_AD** is a dummy variable, equals to one when the board has three academic directors sitting in the board, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Model	Model	Model	Model	Model	Model
D1_AD	-0.012	-0.012	-0.019	-0.019	-0.011	-0.011
	(0.028)	(0.029)	(0.028)	(0.029)	(0.029)	(0.030)
D2_AD	-0.035	-0.031	-0.036	-0.032	-0.034	-0.030
	(0.032)	(0.033)	(0.032)	(0.033)	(0.033)	(0.034)
D3_AD	0.002	0.001	-0.004	-0.005	0.003	0.002
	(0.039)	(0.040)	(0.039)	(0.040)	(0.041)	(0.041)
FS	-1.323***	-1.347***	-1.288***	-1.308***	-1.359***	-1.377***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)
Leverage	1.046***	1.018***	0.939***	0.907***	1.070***	1.033***
	(0.054)	(0.055)	(0.054)	(0.055)	(0.056)	(0.057)
Tan	-0.578***	-0.581***	-0.164*	-0.163*	-0.598***	-0.596***
	(0.086)	(0.087)	(0.085)	(0.086)	(0.088)	(0.089)
Growth	0.055***	0.065***	0.052***	0.062***	0.056***	0.066***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Capex	2.340***	2.427***	2.598***	2.683***	2.410***	2.487***
	(0.209)	(0.212)	(0.207)	(0.210)	(0.215)	(0.217)
BS	0.023***	0.024***	0.024***	0.025***	0.024***	0.025***
	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)	(0.009)
Independent	0.941***	0.939***	0.944***	0.940***	0.977***	0.971***
	(0.226)	(0.229)	(0.224)	(0.227)	(0.232)	(0.235)
Year Dummy	YES	YES	YES	YES	YES	YES
Constant	28.141***	28.702***	26.902***	27.401***	28.890***	29.338***
	(0.355)	(0.361)	(0.352)	(0.357)	(0.365)	(0.369)
Observations	16,815	16,815	16,815	16,815	16,815	16,815
R-squared	0.455	0.451	0.450	0.447	0.451	0.449
Number of stkcd	1,541	1,541	1,541	1,541	1,541	1,541
Adj. R-squared	0.399	0.395	0.393	0.391	0.395	0.392

Table 2.6.1(3) The relationship between school affiliation of AIDs and firm performance (FE)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_985** is a dummy variable that is equal to one if a firm has at least one AIDs from 985 group university, and zero otherwise. **DUM_211** is a dummy variable that is equal to one if a firm has at least one AIDs from 211 group university, and zero otherwise. **DUM_No985/211** is a dummy variable that is equal to one if a firm has at least one academic director from out of 985 and 211 groups university, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

VARIABLES	(1) Model	(2) Model	(3) Model
DUM_985	-0.004		
	(0.024)		
DUM_211		-0.078***	
		(0.026)	
DUM_NO985/211			-0.035
			(0.024)
FS	-1.324***	-1.322***	-1.323***
	(0.016)	(0.016)	(0.016)
Leverage	1.047***	1.044***	1.044***
	(0.054)	(0.054)	(0.055)
Tan	-0.577***	-0.575***	-0.578***
	(0.086)	(0.086)	(0.086)
Growth	0.055***	0.055***	0.055***
	(0.011)	(0.011)	(0.011)
Capex	2.340***	2.335***	2.340***
	(0.209)	(0.209)	(0.209)
BS	0.024***	0.024***	0.024***
	(0.008)	(0.008)	(0.008)
Independent	0.945***	0.972***	0.963***
	(0.225)	(0.225)	(0.225)
Year Dummy	YES	YES	YES
Constant	28.143***	28.102***	28.125***
	(0.355)	(0.355)	(0.355)
Observations	16,815	16,815	16,815
R-squared	0.455	0.455	0.455
Number of stkcd	1,541	1,541	1,541
Adj. R-squared	0.399	0.399	0.399

Table 2.6.1(4) The relationship between administrative position of AIDs and firm performance (FE)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_PRES** is a dummy variable that is equal to one if a firm has at least one AIDs is president sitting in the board, and zero otherwise. **DUM_VPRES**is a dummy variable that is equal to one if a firm has at least one AIDs is Vic president sitting in the board, and zero otherwise. **DUM_Chairman** is a dummy variable that is equal to one if a firm has at least one AIDs is chairman sitting in the board, and zero otherwise. **DUM_Dean** is a dummy variable that is equal to one if a firm has at least one AIDs is deans sitting in the board, and zero otherwise. **DUM_DOI** is a dummy variable that is equal to one if a firm has at least one AIDs is director of the institute sitting in the board, and zero otherwise. **DUM_Division** is a dummy variable that is equal to one if a firm has at least one AIDs is division head sitting in the board, and zero otherwise. **DUM_Administer** is a dummy variable that is equal to one if a firm has at least one AIDs with administered position sitting in the board, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

VARIABLES	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model	(7) Model
DUM_PRES	0.032						
	(0.067)						
DUM_VPRES		-0.016					
		(0.043)					
DUM_Chairman			0.003				
			(0.023)				
DUM_Dean				0.005			
				(0.023)			
DUM_DOI					0.060		
					(0.040)		
DUM_Division						-0.078	
						(0.071)	
DUM_Administer							-0.029
							(0.022)

FS	-1.324***	-1.324***	-1.325***	-1.325***	-1.326***	-1.324***	-0.775***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Leverage	1.048***	1.047***	1.048***	1.048***	1.046***	1.048***	1.084***
	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	(0.092)
Tan	-0.578***	-0.577***	-0.576***	-0.577***	-0.578***	-0.578***	-0.550***
	(0.086)	(0.086)	(0.086)	(0.086)	(0.086)	(0.086)	(0.073)
Growth	0.054***	0.055***	0.054***	0.055***	0.055***	0.054***	0.035*
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.019)
Capex	2.341***	2.342***	2.341***	2.341***	2.341***	2.340***	1.782***
	(0.209)	(0.209)	(0.209)	(0.209)	(0.209)	(0.209)	(0.225)
BS	0.023***	0.024***	0.023***	0.023***	0.023***	0.024***	0.039***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.006)
Independent	0.939***	0.944***	0.941***	0.939***	0.938***	0.943***	1.982***
	(0.225)	(0.224)	(0.225)	(0.225)	(0.224)	(0.224)	(0.233)
Year Dummy	YES	YES	YES	YES	YES	YES	YES
Constant	28.145***	28.145***	28.145***	28.146***	28.164***	28.136***	15.859***
	(0.355)	(0.355)	(0.355)	(0.355)	(0.355)	(0.355)	(0.308)
Observations	16,815	16,815	16,815	16,815	16,815	16,815	16,815
R-squared	0.455	0.455	0.455	0.455	0.455	0.455	0.423
Number of stkcd	1,541	1,541	1,541	1,541	1,541	1,541	
Adj. R-squared	0.399	0.399	0.399	0.399	0.399	0.399	0.422

Table 2.6.1(5) The relationship between academic position and firm performance (FE)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_Professor** is a dummy variable that is equal to one if a firm has at least one AIDs is professor in the board, and zero otherwise. **DUM_AssoProf**is a dummy variable that is equal to one if a firm has at least one AIDs is ass-professor sitting in the board, and zero otherwise. **DUM_PhD Supervisor** is a dummy variable that is equal to one if a firm has at least one AIDs is supervisor for PhD sitting in the board, and zero otherwise. **DUM_Research** is a dummy variable that is equal to one if a firm has at least one AIDs is research fellow sitting in the board, and zero otherwise. **DUM_NAE** is a dummy variable that is equal to one if a firm has at least one AID is NAE sitting in the board, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

VARIABLES	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model
DUM_Professor	-0.023				
	(0.025)				
DUM_AssoProf		-0.025			
		(0.033)			
DUM_PhD Supervisor			0.052**		
			(0.024)		
DUM_Research				0.025	
				(0.048)	
DUM_NAE					0.113*
					(0.068)
FS	-1.324***	-1.325***	-1.326***	-1.324***	-1.325***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Leverage	1.045***	1.048***	1.053***	1.048***	1.050***
	(0.055)	(0.054)	(0.055)	(0.054)	(0.054)
Tan	-0.578***	-0.577***	-0.576***	-0.576***	-0.576***
	(0.086)	(0.086)	(0.086)	(0.086)	(0.086)
Growth	0.055***	0.055***	0.054***	0.054***	0.055***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Capex	2.339***	2.342***	2.336***	2.340***	2.341***
	(0.209)	(0.209)	(0.209)	(0.209)	(0.209)
BS	0.024***	0.024***	0.022***	0.023***	0.023***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Independent	0.958***	0.945***	0.913***	0.939***	0.936***
	(0.225)	(0.224)	(0.225)	(0.224)	(0.224)
Year Dummy	YES	YES	YES	YES	YES

Constant	28.134***	28.151***	28.171***	28.145***	28.158***
	(0.355)	(0.355)	(0.355)	(0.355)	(0.355)
Observations	16,815	16,815	16,815	16,815	16,815
R-squared	0.455	0.455	0.455	0.455	0.455
Number of stkcd	1,541	1,541	1,541	1,541	1,541
Adj. R-squared	0.399	0.399	0.399	0.399	0.399

Table 2.6.1(6): The relationship between AIDs with various subject expertise and firm performance (FE)

VARIABLES	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model
DUM_EFA	-0.009				-0.008
	(0.025)				(0.025)
DUM_LAW		0.054			0.052
		(0.033)			(0.033)
DUM_SCI			-0.047		-0.046
			(0.030)		(0.031)
DUM_ART				-0.034	-0.038
				(0.093)	(0.093)
FS	-1.324***	-1.324***	-1.325***	-1.324***	-1.324***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Leverage	1.047***	1.049***	1.047***	1.047***	1.048***
	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)
Tan	-0.577***	-0.576***	-0.576***	-0.578***	-0.576***
	(0.086)	(0.086)	(0.086)	(0.086)	(0.086)
Growth	0.055***	0.054***	0.055***	0.055***	0.054***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Capex	2.340***	2.340***	2.344***	2.338***	2.340***
	(0.209)	(0.209)	(0.209)	(0.209)	(0.209)
BS	0.024***	0.023***	0.024***	0.024***	0.024***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Independent	0.947***	0.924***	0.951***	0.944***	0.940***
	(0.225)	(0.225)	(0.224)	(0.224)	(0.225)
Year Dummy	YES	YES	YES	YES	YES

Constant	28.141***	28.145***	28.146***	28.144***	28.142***
	(0.355)	(0.355)	(0.355)	(0.355)	(0.355)
Observations	16,815	16,815	16,815	16,815	16,815
R-squared	0.455	0.455	0.455	0.455	0.455
Number of stkcd	1,541	1,541	1,541	1,541	1,541
Adj. R-squared	0.399	0.399	0.399	0.399	0.399

2.6.2 Endogeneity Issue due to Omitted Variable Bias

In this section, I employ difference-in-difference approach to further address the concerns that the findings on the causal relationship between AIDs and firm performance. I use the resignation of academic directors plausibly exogenous to firm characteristics to test the role of academic directors in the company. The exogenous shock I used was Regulation 11, issued by the Chinese Ministry of Education, and the enactment time was 3rd of November 2015. The regulation requires that AIDs with administrative positions cannot serve as directors in listed companies, triggering a wave of AID resignations.

The Regulation 11 evolved from the Rule 18, issued by the Communist Party of China on October 19, 2013.

It prohibits government officials as directors in listed companies, to reduce corruption. (Hope et al. 2017; Hu et al., 2019). The Regulation 11 is suitable for AIDs, when AID have an administrative rank comparable to government officials.

Because the main advantage to firm of academic director include **REPUTATION EFFECT, EXPERTISE EFFECT, INDEPENDENT EFFECT**, Academic director has more prominent these characteristics when he has administrative positions in University. Therefore, the retreat of University leaders can explain the impact of academic director changes on the firm performance. I use this shock DID.

DID setting

Time	Before		After
Treatment Group	Firm has academic director (with administer position) sitting in the board	**Shock (Regulation 11)**	Firm change to no academic director (with administer position) sitting in the board
Control Group	Firm without academic director sitting in the board		Firm without academic director sitting in the board

$$Tobin's\ Q_{i,t} = \beta_0 + \beta_1 * Post_t + \beta_2 * Treated_i + \beta_3 * Post_t * Treated_i + \beta_4 AGE_{i,t} + \beta_5 TA_{i,t} + \beta_6 TL_{i,t} + \beta_7 NFA_{i,t} + \beta_8 BoardSize_{i,t} + \beta_9 Independent_{i,t} + \beta_{10} LEV_{i,t} + \beta_{11} INV_{i,t} + \varepsilon_{i,t}$$

Model 2

To check the effect of AIDs on firm performance, I are interested in the coefficient of interactive term $Post_t * Treated_i$, i.e., β_3. Based on the discussion before, the β_3 should be negative, which means that departure of AIDs has negative impact on firm performance or AIDs have positive impact on firm performance. The results in Table 4.6.2(1) and Table 4.6.2(2) show that the coefficients on interactive term $Post_t * Treated_i$ are not significant at 10% significance level. These results indicate that AIDs sitting on the boards are not beneficial to the firm performance. The difference-in-difference analysis results are similar to the results using OLS and fixed effect analysis.

Table 2.6.2(1): Difference-in-Difference Analysis (TQ)

Tq01-04 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **Treated** is a dummy variable that is equal to one if a firm has at least one AID prior to the introduction of the Regulation 11 (treated group) and equals to zero is this not the case (control group). **Post** is a dummy variable a dummy variable that is equal to one in the year after Regulation 11(after 2015) and 0 in the years preceding its introduction (before 2015). **P*T** indicates Pose multiply by Treated. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board. **Inv** indicates the investment of firms. **Age** indicates the age of firms. **NFA** indicates net fixed assets of firms.

	(1)	(2)	(3)	(4)
VARIABLES	**Model**	**Model**	**Model**	**Model**
P*T	**0.004**	**0.005**	**0.005**	**0.005**
	(0.046)	**(0.047)**	**(0.046)**	**(0.046)**
Treated	0.087***	0.090***	0.074***	0.077***
	(0.020)	(0.021)	(0.020)	(0.021)
Post	1.037***	1.066***	0.985***	1.012***
	(0.046)	(0.047)	(0.046)	(0.047)
Inv	-0.889***	-0.843***	-0.249	-0.193
	(0.185)	(0.191)	(0.184)	(0.188)
Lev	-1.096***	-1.184***	-1.013***	-1.100***
	(0.061)	(0.063)	(0.061)	(0.062)
Age	0.027***	0.024***	0.031***	0.028***
	(0.002)	(0.002)	(0.002)	(0.002)
Ta	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
NFA	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
BS	-0.057***	-0.059***	-0.057***	-0.059***
	(0.004)	(0.005)	(0.004)	(0.004)
Independent	0.187	0.199	0.117	0.125
	(0.193)	(0.198)	(0.194)	(0.196)
Year Dummy	Yes	Yes	Yes	Yes
Industry Dummy	Yes	Yes	Yes	Yes
Constant	2.147***	2.277***	1.747***	1.873***
	(0.111)	(0.114)	(0.112)	(0.114)
Observations	20,393	20,393	20,393	20,393
R-squared	0.232	0.230	0.219	0.219
Adj. R-squared	0.230	0.229	0.218	0.218

Table 2.6.2(2): Difference-in-Difference Analysis (ROA)

ROA indicates net income divided by total assets. **Treated** is a dummy variable that is equal to one if a company has at least one AID after the Regulation 11 (treated group) and equals to zero is this not AID (control group). **Post** Is a dummy variable a dummy variable that is equal to one in the year after Regulation 11(after 2015) and 0 in the years before Regulation 11 (before 2015). **P*T** indicates Pose multiply by Treated. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board. **Inv** indicates the investment of firms. **Age** indicates the age of firms. **NFA** indicates net fixed assets of firms.

	(1)
VARIABLES	Model
Post*Treated	**-0.001**
	(0.002)
Treated	0.001
	(0.001)
Post	0.015***
	(0.002)
Inv	0.156***
	(0.008)
Lev	-0.106***
	(0.003)
Age	-0.000***
	(0.000)
Ta1	0.000***
	(0.000)
NFA	-0.000***
	(0.000)
BS	0.001***
	(0.000)
Independent	-0.008
	(0.009)
Year Dummy	YES
Industry Dummy	YES
Constant	0.046***
	(0.005)
Observations	20,393
R-squared	0.177
Adj. R-squared	0.175

2.7 Robustness Check

2.7.1. Alternative dependent variable

To check the robustness of results, I use the ROA as the dependent variable and rerun regression for main results. To save space, I only report the fixed effect results. The results using other methods are similar to these results. The results in Table 2.7.1(1) to 2.1.7(6) are quite similar to the previous results.

Table 2.7.1(1) The relationship between the presence of AIDs and firm performance (ROA, ROE+ FE)

VARIABLES	(1) Model	(2) Model
DUM_AID	0.002	0.012**
	(0.001)	(0.006)
FS	0.005***	-0.009**
	(0.001)	(0.004)
Leverage	-0.146***	-0.064***
	(0.003)	(0.012)
Tan	-0.051***	-0.076***
	(0.005)	(0.019)
Growth	0.014***	0.033***
	(0.001)	(0.002)
Capex	0.120***	0.393***
	(0.011)	(0.046)
BS	-0.001*	-0.006***
	(0.000)	(0.002)
Independent	0.005	-0.062
	(0.012)	(0.050)
Year Dummy	YES	YES
Constant	-0.006	0.306***
	(0.019)	(0.079)
Observations	16,815	16,815
R-squared	0.229	0.031
Number of stkcd	1,541	1,541
Adj. R-squared	0.150	-0.068

Table 2.7.1(2)：the relationship between have one academic director sitting in the board or have two or have three and more, and ROA, ROE (FIXED EFFECT)

VARIABLES	(1) Model	(2) Model
D1_AD	0.002	0.014**
	(0.001)	(0.006)
D2_AD	0.003	0.010
	(0.002)	(0.007)
D3_AD	0.001	0.008
	(0.002)	(0.009)
FS	0.005***	-0.009**
	(0.001)	(0.004)
Leverage	-0.146***	-0.064***
	(0.003)	(0.012)
Tan	-0.051***	-0.076***
	(0.005)	(0.019)
Growth	0.014***	0.033***
	(0.001)	(0.002)
Capex	0.120***	0.392***
	(0.011)	(0.046)
BS	-0.001*	-0.006***
	(0.000)	(0.002)
Independent	0.007	-0.059
	(0.012)	(0.050)
Year Dummy	YES	YES
Constant	-0.006	0.306***
	(0.019)	(0.079)
Observations	16,815	16,815
R-squared	0.229	0.031
Number of stkcd	1,541	1,541
Adj. R-squared	0.150	-0.068

Table 2.7.1(3)：the relationship between the level of university and ROA (FIXED EFFECT)

VARIABLES	(1) Model	(2) Model	(3) Model
DUM_985	0.001		
	(0.001)		
DUM_211		-0.000	
		(0.001)	
DUM_NO985/211			0.001
			(0.001)
FS	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)
Leverage	-0.146***	-0.146***	-0.146***
	(0.003)	(0.003)	(0.003)
Tan	-0.051***	-0.051***	-0.051***
	(0.005)	(0.005)	(0.005)
Growth	0.014***	0.014***	0.014***
	(0.001)	(0.001)	(0.001)
Capex	0.120***	0.120***	0.120***
	(0.011)	(0.011)	(0.011)
BS	-0.001*	-0.001*	-0.001*
	(0.000)	(0.000)	(0.000)
Independent	0.006	0.007	0.006
	(0.012)	(0.012)	(0.012)
Year Dummy	YES	YES	YES
Constant	-0.005	-0.006	-0.006
	(0.019)	(0.019)	(0.019)
Observations	16,815	16,815	16,815
R-squared	0.229	0.228	0.229
Number of stkcd	1,541	1,541	1,541
Adj. R-squared	0.150	0.150	0.150

Table 2.7.1(4)：the relationship between academic position and ROA (FIXED EFFECT)

VARIABLES	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model
DUM_Professor	0.001				
	(0.001)				
DUM_AssoProf		0.001			
		(0.002)			
DUM_PhD Supervisor			-0.000		
			(0.001)		
DUM_Researcher				0.003	
				(0.003)	
DUM_NAE					-0.002
					(0.004)
FS	0.005***	0.005***	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Leverage	-0.146***	-0.146***	-0.146***	-0.146***	-0.146***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Tan	-0.051***	-0.051***	-0.051***	-0.051***	-0.051***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Growth	0.014***	0.014***	0.014***	0.014***	0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Capex	0.120***	0.120***	0.120***	0.120***	0.120***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
BS	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Independent	0.006	0.007	0.007	0.006	0.007
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Year Dummy	YES	YES	YES	YES	YES
Constant	-0.006	-0.006	-0.006	-0.006	-0.006
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Observations	16,815	16,815	16,815	16,815	16,815
R-squared	0.229	0.228	0.228	0.229	0.229
Number of stkcd	1,541	1,541	1,541	1,541	1,541
Adj. R-squared	0.150	0.150	0.150	0.150	0.150

Standard errors in parentheses

Table 2.1.7(5)：the relationship between administration position and ROA (FIXED EFFECT)

VARIABLES	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model	(7) Model
DUM_PRES	0.002						
	(0.004)						
DUM_VPRES		0.005**					
		(0.002)					
DUM_Chairman			-0.001				
			(0.001)				
DUM_Dean				-0.000			
				(0.001)			
DUM_DOI					-0.002		
					(0.002)		
DUM_Division						-0.000	
						(0.004)	
DUM_Administer							0.003***
							(0.001)
FS	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Leverage	-0.146***	-0.146***	-0.146***	-0.146***	-0.146***	-0.146***	-0.123***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Tan	-0.051***	-0.051***	-0.051***	-0.051***	-0.051***	-0.051***	-0.046***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.003)
Growth	0.014***	0.014***	0.014***	0.014***	0.014***	0.014***	0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Capex	0.120***	0.120***	0.120***	0.120***	0.120***	0.120***	0.182***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.010)

BS	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Independent	0.007	0.006	0.007	0.007	0.007	0.007	-0.033***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.010)
Year Dummy	YES	YES	YES	YES	YES	YES	YES
Constant	-0.006	-0.006	-0.006	-0.006	-0.007	-0.006	-0.144***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.010)
Observations	16,815	16,815	16,815	16,815	16,815	16,815	16,815
R-squared	0.228	0.229	0.229	0.228	0.229	0.228	0.279
Number of stkcd	1,541	1,541	1,541	1,541	1,541	1,541	
Adj. R-squared	0.150	0.150	0.150	0.150	0.150	0.150	0.278

Table 2.1.7(6)：the relationship between the major of academic director and ROA (FIXED EFFECT)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_EFA** is a dummy variable that is equal to one if a firm has at least one AID come from economic, finance or accounting school, and zero otherwise. **DUM_LAW** is a dummy variable that is equal to one if a firm has at least one AID come from law school, and zero otherwise. **DUM_SCI** is a dummy variable that is equal to one if a firm has at least one AID come from science school, and zero otherwise. **DUM_ART** is a dummy variable that is equal to one if a firm has at least one AID come from arts school, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

VARIABLES	(1) Model	(2) Model	(3) Model	(4) Model
DUM_EFA	0.002			
	(0.001)			
DUM_LAW		0.000		
		(0.002)		
DUM_SCI			-0.000	
			(0.002)	
DUM_ART				0.007
				(0.005)
FS	0.005***	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Leverage	-0.146***	-0.146***	-0.146***	-0.146***
	(0.003)	(0.003)	(0.003)	(0.003)
Tan	-0.051***	-0.051***	-0.051***	-0.051***
	(0.005)	(0.005)	(0.005)	(0.005)
Growth	0.014***	0.014***	0.014***	0.014***
	(0.001)	(0.001)	(0.001)	(0.001)
Capex	0.120***	0.120***	0.120***	0.121***
	(0.011)	(0.011)	(0.011)	(0.011)
BS	-0.001*	-0.001*	-0.001*	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)
Independent	0.006	0.007	0.007	0.006
	(0.012)	(0.012)	(0.012)	(0.012)
Year Dummy	YES	YES	YES	YES
Constant	-0.005	-0.006	-0.006	-0.006
	(0.019)	(0.019)	(0.019)	(0.019)
Observations	16,815	16,815	16,815	16,815
R-squared	0.229	0.228	0.228	0.229
Number of stkcd	1,541	1,541	1,541	1,541
Adj. R-squared	0.150	0.150	0.150	0.150

2.7.2. Alternative independent variable

In addition, to check the robustness of results, I focus on the ratio of AIDs sitting on the board and use this as alternative independent variable and investigate the relationship between the ratio of AIDs and firm performance. Table 2.7.2(1) shows that there is no relationship between the ratio of AIDs and firm performance as the coefficients of variable AID_RATIO is insignificant across various models. These results are consistent with the results in previous analysis.

Table 2.7.2(1): The relationship between the ratio of AIDs and firm performance (OLS)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **AID Ratio** represents the percent of academic independent directors on board. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Model	Model	Model	Model	Model	Model
AID Ratio	0.049	0.042	0.009	0.003	0.016	0.010
	(0.093)	(0.094)	(0.092)	(0.093)	(0.096)	(0.097)
FS	-0.776***	-0.795***	-0.749***	-0.767***	-0.786***	-0.803***
	(0.016)	(0.017)	(0.016)	(0.016)	(0.017)	(0.017)
Leverage	1.087***	1.079***	0.985***	0.971***	1.126***	1.106***
	(0.092)	(0.094)	(0.090)	(0.091)	(0.097)	(0.098)
Tan	-0.548***	-0.570***	-0.097	-0.116	-0.572***	-0.590***
	(0.073)	(0.075)	(0.072)	(0.073)	(0.076)	(0.077)
Growth	0.035*	0.048**	0.035*	0.047**	0.034*	0.047**
	(0.019)	(0.020)	(0.019)	(0.020)	(0.020)	(0.020)
Capex	1.785***	1.887***	2.000***	2.099***	1.791***	1.883***
	(0.225)	(0.229)	(0.219)	(0.223)	(0.233)	(0.237)
BS	0.038***	0.040***	0.036***	0.037***	0.041***	0.042***
	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)
Independent	1.954***	2.019***	1.884***	1.942***	2.076***	2.129***
	(0.235)	(0.240)	(0.232)	(0.236)	(0.244)	(0.247)
Year Dummy	YES	YES	YES	YES	YES	YES
Industry Dummy	YES	YES	YES	YES	YES	YES
Constant	15.862***	16.292***	14.935***	15.338***	16.005***	16.387***
	(0.308)	(0.314)	(0.304)	(0.308)	(0.321)	(0.324)
Observations	16,815	16,815	16,815	16,815	16,815	16,815
R-squared	0.423	0.423	0.409	0.410	0.414	0.415
Adj. R-squared	0.421	0.422	0.408	0.409	0.413	0.414

Table 2.7.2(2) The relationship between academic ratio and tq1,2,3,4,5,6(FIXED EFFECT)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **AID Ratio** represents the percent of academic independent directors on board. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

VARIABLES	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model
AID Ratio	-0.033	-0.030	-0.034	-0.030	-0.031	-0.028
	(0.099)	(0.100)	(0.098)	(0.099)	(0.101)	(0.102)
FS	-1.324***	-1.348***	-1.289***	-1.309***	-1.360***	-1.378***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)
Leverage	1.047***	1.019***	0.941***	0.909***	1.072***	1.034***
	(0.054)	(0.055)	(0.054)	(0.055)	(0.056)	(0.057)
Tan	-0.577***	-0.580***	-0.162*	-0.161*	-0.596***	-0.595***
	(0.086)	(0.087)	(0.085)	(0.086)	(0.088)	(0.089)
Growth	0.055***	0.065***	0.052***	0.062***	0.055***	0.066***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Capex	2.340***	2.427***	2.598***	2.683***	2.410***	2.486***
	(0.209)	(0.212)	(0.207)	(0.210)	(0.215)	(0.217)
BS	0.023***	0.024***	0.024***	0.025***	0.024***	0.025***
	(0.008)	(0.009)	(0.008)	(0.008)	(0.009)	(0.009)
Independent	0.952***	0.949***	0.952***	0.946***	0.987***	0.980***
	(0.226)	(0.230)	(0.224)	(0.227)	(0.233)	(0.235)
Year Dummy	YES	YES	YES	YES	YES	YES
Constant	28.146***	28.706***	26.908***	27.406***	28.895***	29.343***
	(0.355)	(0.360)	(0.352)	(0.356)	(0.365)	(0.369)
Observations	16,815	16,815	16,815	16,815	16,815	16,815
R-squared	0.455	0.451	0.450	0.447	0.451	0.449
Number of stkcd	1,541	1,541	1,541	1,541	1,541	1,541
Adj. R-squared	0.399	0.395	0.393	0.391	0.395	0.392

2.7.3. Alternative method addressing time-constant omitted variable.

I also use the random effect to run regression to check the robustness of the main results. Results in Table 2.7.3(1)-2.7.3(7) show the similar results to previous results, which indicates that the results are robust to the various methods used in this study.

Table 2.7.3(1)：The relationship between the presence of AIDs and firm performance (RE)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_AID** is a dummy variable that is equal to one if a firm has at least one academic independent director, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Model	Model	Model	Model	Model	Model
DUM_AID	-0.039	-0.039	-0.044*	-0.044*	-0.040	-0.040
	(0.026)	(0.026)	(0.026)	(0.026)	(0.027)	(0.027)
FS	-1.032***	-1.060***	-0.998***	-1.024***	-1.056***	-1.081***
	(0.013)	(0.013)	(0.012)	(0.013)	(0.013)	(0.013)
Leverage	1.093***	1.064***	0.987***	0.953***	1.124***	1.084***
	(0.050)	(0.051)	(0.050)	(0.050)	(0.052)	(0.052)
Tan	-0.492***	-0.504***	-0.061	-0.070	-0.510***	-0.518***
	(0.077)	(0.078)	(0.076)	(0.077)	(0.079)	(0.080)
Growth	0.032***	0.043***	0.030***	0.041***	0.032***	0.043***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Capex	2.169***	2.280***	2.420***	2.529***	2.225***	2.326***
	(0.206)	(0.209)	(0.204)	(0.206)	(0.212)	(0.214)
BS	0.041***	0.042***	0.041***	0.042***	0.043***	0.044***
	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)
Independent	1.441***	1.453***	1.420***	1.429***	1.503***	1.506***
	(0.216)	(0.219)	(0.214)	(0.216)	(0.222)	(0.224)
Year Dummy	YES	YES	YES	YES	YES	YES
Industry Dummy	YES	YES	YES	YES	YES	YES
Constant	21.335***	21.981***	20.208***	20.811***	21.784***	22.361***
	(0.305)	(0.312)	(0.302)	(0.307)	(0.315)	(0.320)
Observations	16,815	16,815	16,815	16,815	16,815	16,815
Number of stkcd	1,541	1,541	1,541	1,541	1,541	1,541
Adj. R-squared	)	)	)	)	)	)

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Table 2.7.3(2)：The relationship between academic ratio and firm performance (RE)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **AID Ratio** represents the percent of academic independent directors on board. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Model	Model	Model	Model	Model	Model
AID Ratio	-0.013	-0.013	-0.024	-0.023	-0.020	-0.020
	(0.092)	(0.094)	(0.091)	(0.093)	(0.095)	(0.096)
FS	-1.033***	-1.061***	-0.999***	-1.025***	-1.057***	-1.082***
	(0.013)	(0.013)	(0.012)	(0.013)	(0.013)	(0.013)
Leverage	1.096***	1.067***	0.990***	0.957***	1.127***	1.087***
	(0.050)	(0.051)	(0.050)	(0.050)	(0.052)	(0.052)
Tan	-0.490***	-0.502***	-0.059	-0.068	-0.509***	-0.516***
	(0.077)	(0.078)	(0.076)	(0.077)	(0.079)	(0.080)
Growth	0.032***	0.043***	0.030***	0.041***	0.031***	0.043***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Capex	2.170***	2.281***	2.421***	2.530***	2.226***	2.327***
	(0.206)	(0.209)	(0.204)	(0.206)	(0.212)	(0.214)
BS	0.040***	0.041***	0.040***	0.041***	0.042***	0.043***
	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)
Independent	1.424***	1.436***	1.403***	1.411***	1.487***	1.490***
	(0.217)	(0.220)	(0.215)	(0.218)	(0.223)	(0.226)
Year Dummy	YES	YES	YES	YES	YES	YES
Industry Dummy	YES	YES	YES	YES	YES	YES
Constant	21.339***	21.985***	20.213***	20.815***	21.789***	22.366***
	(0.305)	(0.312)	(0.302)	(0.307)	(0.315)	(0.320)
Observations	16,815	16,815	16,815	16,815	16,815	16,815
Number of stkcd	1,541	1,541	1,541	1,541	1,541	1,541
Adj. R-squared	)	)	)	)	)	)

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Table 2.7.3(3)：The relationship between the number of AIDs and firm performance (RE)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **D1_AD** is a dummy variable, equals to one when the board has one academic director sitting in the board, and zero otherwise. **D2_AD** is a dummy variable, equals to one when the board has two academic directors sitting in the board, and zero otherwise. **D3_AD** is a dummy variable, equals to one when the board has three academic directors sitting in the board, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

VARIABLES	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model
D1_AD	-0.043	-0.044	-0.049*	-0.050*	-0.043	-0.044
	(0.028)	(0.028)	(0.027)	(0.028)	(0.028)	(0.029)
D2_AD	-0.049	-0.047	-0.052*	-0.050	-0.051	-0.049
	(0.031)	(0.031)	(0.031)	(0.031)	(0.032)	(0.032)
D3_AD	0.014	0.011	0.005	0.003	0.011	0.009
	(0.037)	(0.038)	(0.037)	(0.037)	(0.038)	(0.038)
FS	-1.032***	-1.060***	-0.998***	-1.024***	-1.056***	-1.081***
	(0.013)	(0.013)	(0.012)	(0.013)	(0.013)	(0.013)
Leverage	1.092***	1.063***	0.986***	0.953***	1.123***	1.083***
	(0.050)	(0.051)	(0.050)	(0.050)	(0.052)	(0.052)
Tan	-0.492***	-0.504***	-0.061	-0.069	-0.510***	-0.518***
	(0.077)	(0.078)	(0.076)	(0.077)	(0.079)	(0.080)
Growth	0.032***	0.043***	0.030***	0.041***	0.032***	0.043***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Capex	2.170***	2.281***	2.422***	2.531***	2.226***	2.327***
	(0.206)	(0.209)	(0.204)	(0.206)	(0.212)	(0.214)
BS	0.039***	0.040***	0.039***	0.040***	0.041***	0.042***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Independent	1.405***	1.418***	1.386***	1.396***	1.467***	1.472***
	(0.217)	(0.220)	(0.215)	(0.217)	(0.223)	(0.225)
Year Dummy	YES	YES	YES	YES	YES	YES
Industry Dummy	YES	YES	YES	YES	YES	YES
Constant	21.352***	21.997***	20.225***	20.828***	21.802***	22.378***
	(0.305)	(0.312)	(0.302)	(0.307)	(0.315)	(0.320)
Observations	16,815	16,815	16,815	16,815	16,815	16,815
Number of stkcd	1,541	1,541	1,541	1,541	1,541	1,541
Adj. R-squared	)	)	)	)	)	)

Standard errors in parentheses

Table 2.7.3(4): The relationship between school affiliation of AIDs and firm performance (RE)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_985** is a dummy variable that is equal to one if a firm has at least one AIDs from 985 group university, and zero otherwise. **DUM_211** is a dummy variable that is equal to one if a firm has at least one AIDs from 211 group university, and zero otherwise. **DUM_No985/211** is a dummy variable that is equal to one if a firm has at least one academic director from out of 985 and 211 groups university, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

	(1)	(2)	(3)
VARIABLES	Model	Model	Model
DUM_985	0.007		
	(0.023)		
DUM_211		-0.067***	
		(0.025)	
DUM_NO985/211			-0.028
			(0.023)
FS	-1.033***	-1.032***	-1.032***
	(0.013)	(0.013)	(0.013)
Leverage	1.097***	1.094***	1.093***
	(0.050)	(0.050)	(0.050)
Tan	-0.489***	-0.489***	-0.492***
	(0.077)	(0.077)	(0.077)
Growth	0.032***	0.032***	0.032***
	(0.011)	(0.011)	(0.011)
Capex	2.170***	2.166***	2.169***
	(0.206)	(0.206)	(0.206)
BS	0.040***	0.041***	0.041***
	(0.008)	(0.008)	(0.008)
Independent	1.416***	1.442***	1.435***
	(0.216)	(0.215)	(0.216)
Year Dummy	YES	YES	YES
Industry Dummy	YES	YES	YES
Constant	21.341***	21.313***	21.326***
	(0.305)	(0.305)	(0.305)
Observations	16,815	16,815	16,815
Number of stkcd	1,541	1,541	1,541
Adj. R-squared	)	)	)

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Table 2.7.3(5)：The relationship between academic position and firm performance (RE)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_Professor** is a dummy variable that is equal to one if a firm has at least one AIDs is professor in the board, and zero otherwise. **DUM_AssoProf** is a dummy variable that is equal to one if a firm has at least one AIDs is ass-professor sitting in the board, and zero otherwise. **DUM_PhD Supervisor** is a dummy variable that is equal to one if a firm has at least one AIDs is supervisor for PhD sitting in the board, and zero otherwise. **DUM_Researcher** is a dummy variable that is equal to one if a firm has at least one AIDs is researcher sitting in the board, and zero otherwise. **DUM_NAE** is a dummy variable that is equal to one if a firm has at least one AID is NAE sitting in the board, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

VARIABLES	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model
DUM_Professor	-0.041*				
	(0.024)				
DUM_AssoProf		-0.037			
		(0.032)			
DUM_PhD Supervisor			0.055**		
			(0.023)		
DUM_Researcher				0.073	
				(0.046)	
DUM_NAE					0.155**
					(0.066)
FS	-1.032***	-1.034***	-1.035***	-1.032***	-1.034***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Leverage	1.092***	1.097***	1.103***	1.098***	1.100***
	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)
Tan	-0.493***	-0.490***	-0.489***	-0.488***	-0.488***
	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)
Growth	0.032***	0.032***	0.031***	0.031***	0.032***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Capex	2.166***	2.171***	2.167***	2.166***	2.170***
	(0.206)	(0.206)	(0.206)	(0.206)	(0.206)
BS	0.042***	0.041***	0.039***	0.040***	0.040***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Independent	1.446***	1.424***	1.389***	1.414***	1.411***
	(0.216)	(0.215)	(0.216)	(0.215)	(0.215)
Year Dummy	YES	YES	YES	YES	YES
Industry Dummy	YES	YES	YES	YES	YES
Constant	21.323***	21.349***	21.368***	21.316***	21.357***
	(0.305)	(0.305)	(0.305)	(0.305)	(0.305)

Observations	16,815	16,815	16,815	16,815	16,815
Number of stkcd	1,541	1,541	1,541	1,541	1,541
Adj. R-squared	)	)	)	)	)

Table 2.7.3(6): The relationship between administrative position of AIDs and firm performance (RE)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_PRES** is a dummy variable that is equal to one if a firm has at least one AIDs is president sitting in the board, and zero otherwise. **DUM_VPRES**is a dummy variable that is equal to one if a firm has at least one AIDs is Vic president sitting in the board, and zero otherwise. **DUM_Chairman** is a dummy variable that is equal to one if a firm has at least one AIDs is chairman sitting in the board, and zero otherwise. **DUM_Dean** is a dummy variable that is equal to one if a firm has at least one AIDs is deans sitting in the board, and zero otherwise. **DUM_DOI** is a dummy variable that is equal to one if a firm has at least one AIDs is director of the institute sitting in the board, and zero otherwise. **DUM_Division** is a dummy variable that is equal to one if a firm has at least one AIDs is division head sitting in the board, and zero otherwise. **DUM_Administer** is a dummy variable that is equal to one if a firm has at least one AIDs with administered position sitting in the board, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

VARIABLES	(1) Model	(2) Model	(3) Model	(4) Model	(5) Model	(6) Model	(7) Model
DUM_PRES	0.102						
	(0.067)						
DUM_VPRES		0.007					
		(0.042)					
DUM_Chairman			0.011				
			(0.023)				
DUM_Dean				-0.009			
				(0.022)			
DUM_DOI					0.028		
					(0.039)		
DUM_Division						-0.159**	
						(0.070)	
DUM_Administer							-0.029
							(0.022)
FS	-1.033***	-1.033***	-1.033***	-1.033***	-1.033***	-1.033***	-0.775***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.016)
Leverage	1.098***	1.097***	1.096***	1.096***	1.096***	1.096***	1.084***

	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)	(0.092)
Tan	-0.492***	-0.490***	-0.490***	-0.490***	-0.491***	-0.492***	-0.550***
	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)	(0.073)
Growth	0.031***	0.032***	0.032***	0.032***	0.032***	0.032***	0.035*
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.019)
Capex	2.172***	2.169***	2.171***	2.169***	2.170***	2.167***	1.782***
	(0.206)	(0.206)	(0.206)	(0.206)	(0.206)	(0.206)	(0.225)
BS	0.040***	0.041***	0.040***	0.041***	0.040***	0.041***	0.039***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.006)
Independent	1.410***	1.419***	1.416***	1.425***	1.418***	1.424***	1.982***
	(0.215)	(0.215)	(0.215)	(0.216)	(0.215)	(0.215)	(0.233)
Year Dummy	YES	YES	YES	YES	YES	YES	YES
Industry Dummy	YES	YES	YES	YES	YES	YES	YES
Constant	21.338***	21.340***	21.339***	21.332***	21.342***	21.332***	15.859***
	(0.305)	(0.305)	(0.305)	(0.305)	(0.305)	(0.305)	(0.308)
Observations	16,815	16,815	16,815	16,815	16,815	16,815	16,815
R-squared							0.423
Number of stkcd	1,541	1,541	1,541	1,541	1,541	1,541	
Adj. R-squared	)	)	)	)	)	)	0.422

Standard errors in parentheses

Table 2.7.3(7): The relationship between the subject area of AIDs and firm performance (RE)

Tq01-06 indicates Tobin's Q which is defined as the market value of total assets divided by book value of total assets. **DUM_EFA** is a dummy variable that is equal to one if a firm has at least one AID come from economic, finance or accounting school, and zero otherwise. **DUM_LAW** is a dummy variable that is equal to one if a firm has at least one AID come from law school, and zero otherwise. **DUM_SCI** is a dummy variable that is equal to one if a firm has at least one AID come from science school, and zero otherwise. **DUM_ART** is a dummy variable that is equal to one if a firm has at least one AID come from arts school, and zero otherwise. **FS** indicates nature log of firm size which is defined as total assets. **Leverage** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **Tan** indicates tangibility which is defined as the ratio of fixed assets to total assets. **Growth** indicates sales growth which is defined as the percentage change in sales year-on-year. **Capex** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **Independent** indicates the ratio of independent director sitting in board.

	(1)	(2)	(3)	(4)
VARIABLES	Model	Model	Model	Model
DUM_EFA	-0.007			
	(0.024)			
DUM_LAW		0.039		
		(0.032)		
DUM_SCI			-0.046	
			(0.029)	
DUM_ART				-0.076
				(0.089)
FS	-1.033***	-1.033***	-1.033***	-1.033***
	(0.013)	(0.013)	(0.013)	(0.013)
Leverage	1.096***	1.097***	1.095***	1.095***
	(0.050)	(0.050)	(0.050)	(0.050)
Tan	-0.491***	-0.490***	-0.490***	-0.492***
	(0.077)	(0.077)	(0.077)	(0.077)
Growth	0.032***	0.032***	0.032***	0.032***
	(0.011)	(0.011)	(0.011)	(0.011)
Capex	2.169***	2.169***	2.176***	2.165***
	(0.206)	(0.206)	(0.206)	(0.206)
BS	0.041***	0.040***	0.041***	0.041***
	(0.008)	(0.008)	(0.008)	(0.008)
Independent	1.424***	1.407***	1.431***	1.424***
	(0.216)	(0.216)	(0.215)	(0.215)
Year Dummy	YES	YES	YES	YES
Industry Dummy	YES	YES	YES	YES
Constant	21.336***	21.338***	21.343***	21.337***
	(0.305)	(0.305)	(0.305)	(0.305)
Observations	16,815	16,815	16,815	16,815
Number of stkcd	1,541	1,541	1,541	1,541

Adj. R-squared	)	)	)	)

2.8 Conclusions

This paper investigates the corporate governance role of academic professors sitting on the board as independent directors. This study focuses on the relationship between AIDs and firm performance, particularly focusing on the impact of the presence of AIDs, the number of AIDS, the school of affiliation of AIDs, the academic position of AIDs, and administrative position of AIDs, and subject expertise of AIDs on firm performance.

This study finds no evidence about the effect of the presence of AIDs sitting on the board on firm performance, no evidence about the effect of the number of AIDs sitting on the board on firm performance, no evidence about the effect of school affiliation of AIDs on firm performance; no evidence about the effect of administrative position of AIDs on firm performance; some evidence about the effect of academic position of AIDs on firm performance; no evidence about the effect of subject expertise of AIDs on firm performance. Overall, based on the sample used in this study, I find no evidence about the effect of AIDs on firm performance.

To address endogeneity issue, I use the fixed effect and difference-in-difference analysis. Both approaches have the similar results as OLS regression analysis. In addition, I use alternative dependent variable, alternative independent variables, and alternative methods to do data analysis. The main results do not change. Overall, the results indicate that there is no effect of AIDs on firm performance. This result is different from the previous studies. The main reason could be that the institutional background of this study is different from the institutional background of other studies. This deserves to do further study in the future.

Chapter 3 MARKET REACTION TO ACADEMIC INDEPENDENT DIRECTORS' DEPARTURE

3.1 Introduction

A big challenge happened by empirical researchers when investigating the value of AIDs to the company is that directors are endogenously determined (e.g., Hermalin and Weisbach, 2003; Raheja, 2005; Harris and Raviv, 2006; Wintoki, Linck, Netter, 2012). For example, some firms are more likely to appoint AIDs sitting on the board than other firms due to uniqle demoneds for academic professors' expertise, social connections or reputations (White, Woidtke, Black, and Schweitzer, 2014). In addition, Dewally and Peck (2010) document that a significant part of directors resigns from company with poor financial performance and weak boards. This suggests that appointments or resignations of AIDs cannot be regarded as exogenous to firms' needs and the market reaction to such appointments or resignations is not informative to evaluate the value of AIDs. To avoid this concern, I need to find a "true" exogeneous shock causing the appointments or resignation of AIDs. Luckily, I find one.

Regulation 11 was published by the Ministry of Education of the People's Republic of China on the 3rd of November 2015. The aim of this regulation was to prohibit university staff from holding any directorship in Chinese listed companies. Since the issue of Regulation 11, many university professors resigned their directorship from the listed companies they serve. Regulation 11 was not expected by the listed companies. Thus, resignations of AIDs can be regarded as exogenous to firms' needs and the market reaction to such resignations is informative on evaluating the value of AIDs.

We exploit this exogeneous change to board composition-Regulation 11. I find that the market

responds positively to the announcement of the departure of independent directors. In particular, the abnormal return is 0.018% on the announcement date (e.g., T=0) of departure of independent directors and is also significant at 1% significance level. I also find that the CARs over various windows are positive and significant at 1% significance level. For example, CAR at window [-1,1] is 0.025% and significant at 1% significance level. These results indicate that investors do not view independent directors are beneficial to the firm based on the sample I used in this study.

In addition, I investigate the market reaction to the resignation of AIDs. I find that the market responds positively to the announcement of the departure of AIDs. In particular, the abnormal return is 0.004% on the announcement date (e.g., T=0) of departure of independent directors and is also significant at 10% significance level. I also find that the CARs over various windows are positive and significant at 1% significance level. For example, CAR at window [-1,1] is 0.008% and significant at 1% significance level. These results indicate that investors do not view AIDs beneficial to the firm based on the sample I used in this study.

The rest of the paper is structured as follows. In Section 2, I present a brief literature review. Section 3 presents hypothesis development. Section 4 describes the data and methodology. Section 5 shows empirical results. Finally, discussion and conclusion are showed in Section 6.

3.2 Literature Review

Davidson III, Xie, and Xu (JAPP2004) investigate the market reaction to the appointment of directors to audit committees. They find that firms respond positively when new members of audit committee have expertise. The finding suggests that markets rewards firms that appoint financial experts to their audit committees.

Lin, Pope, and Young (JBFA2003) investigate the market reaction to the appointment of outside directors focusing on UK listed firms. It finds that the market response to the appointment of outside directors is more favorable when the ownership of the board is low and the outside directors possess strong monitoring incentives, and the appointment of independent and manager-connected outside directors does not have that characteristics.

Defond, Hann, and Hu (JAR2005) investigate whether the market responds positively to the appointment of directors with financial expertise to the audit committee. They find that there is a positive market response to the appointment of accounting financial experts, but no significant market reaction to the non-accounting financial experts to the audit committees. It also finds that the positive market reaction is concentrated among firms with good corporate governance. Overall, these findings suggest that financial expertise on audit committees help to improve corporate governance.

Huang, Hsu, Khan, and Yu (EMFT2008) investigate the market reaction to the appointment of outside directors. It finds that there is a positive market reaction to the appointment of outside directors. Also, the market reaction is higher when firms have poor corporate governance, CEO

and chairman is the same person, have more free cash flows and a higher degree of information asymmetry. The findings indicate that the appointment of outside directors is more beneficial to firms with poor corporate governance mechanism.

Ismail and Manaf (JMFM2016) investigate the market reaction to the appointment of female directors to the board. They find that market responds positively when the female directors are prominent, young and non-internationally exposed directors. Also, they find that the market responds negatively when the female directors have family relationship with other directors.

Kang, Ding and Charoenwong (JBR2010) investigate the market reaction to the appointment of female directors sitting on the board focusing on Singaporean firms. They find that there is a significant positive market reaction to the appointment of female directors sitting on the board. Also they find that the market responds more favorably when the female is more independent and less favorably when the female takes the CEO role as well.

White, Woidtke, Black and Schweitzer (2014) investigate the appointments of academic directors. This study focuses on two main questions. The first one is what factors influence the appointment of an academic directors. The second one is if investors view academic directors differently based on firm, board and director heterogeneities. Based on 284 academic director appointments available in their sample, they find that academic directors tend to be appointed by small- and mid-cap firms. In addition, they find that the factors influencing appointments vary with the type and characteristics of AIDs. In particular, firms with greater advertising needs are more likely to appoint AIDs with administrative role and sitting on other boards, and AIDs from non-top 25 Universities. The market responds insignificantly to the appointment of AIDs with administrative

role on average. It responds positively when AIDs have administrative role in business school, and it responds negatively when AIDs do not have administrative role in a business school. These results indicate that companies appoint AIDs with administrative role to supplement the advising and monitoring role of existing directors through their business ties.

In addition, they find that smaller firms with general business expertise needs are more likely to appoint AIDs with business background. The market reaction to the appointment of AIDs with business background is not significant on average. The reaction is larger for lower risk firms and firms investing more in advertising. The reaction is smaller when AIDs with business background are connected with CEOs. These results indicate that companies appoint AIDs with business background to enhance their monitoring and advising role through their reputation and business expertise. In addition, they find no significant market reaction to the appointment of academic directors.

Falato, Kadyrzhanova, and Lel (JF2014) investigate the market reaction to the deaths of directors and CEO at interlocked firms. They find a significant negative market reaction. The results indicate that directors' busyness is detrimental to board monitoring effectiveness and shareholder value.

Nguyen and Nielsen (JFE2010) investigates the market reaction to the sudden deaths of independent directors focusing on US firms. They find that the market responds negatively, and the degree of market reaction is determined by the degree of independence and board structure. In addition, independence is more valuable in board function. The results suggest that independent directors are beneficial to shareholder value.

Overall, these previous literatures have researched the market reaction to the appointment of female director, appointment of directors to audit committees and appointment of directors with financial expertise to the audit committee. However, little literature investigates the market reaction to the resignation of academic independent director. In addition, it is weak in controlling endogeneity problems from the existing literature on academic independent director. To avoid this concern, I need to find a "true" exogeneous shock causing the appointments or resignation of AIDs. Regulation 11 was published by the Ministry of Education of the People's Republic of China on the 3rd of November 2015. The aim of this regulation was to prohibit university staff from holding any directorship in Chinese listed companies. Since the issue of Regulation 11, many university professors resigned their directorship from the listed companies they serve. Regulation 11 was not expected by the listed companies. Thus, resignations of AIDs can be regarded as exogenous to firms' needs and the market reaction to such resignations is informative on evaluating the value of AIDs. I can design an event study to research the market reaction to the resignation of academic director through regulation 11. Then study the value of academic director to the firm through the market reaction.

3.3 Event Study Method

The impact of an economic event on market reaction is a popular question in financial research. How to measure market reaction is difficult. However, I can use event-study analysis to solve this problem though constructing a metric by financial market data. The usefulness come from event-study that the impact of an event is immediately reflected in asset price in the rationality financial market. Conversely, a long time of observation might be used by other method.

According to the duration of the impact of events, the event study method is usually divided into short-term event research and long-term event research in the literature (Brown and Warner, 1980; Fama, 1991). In the field of corporate finance, the Dailey Event Study provides a good metric for measuring the impact of an event on the wealth of a company's shareholders, namely Cumulative Abnormal Returns (CARs).

Three basic assumptions that the short-term event research approach relies on: First, according to the Efficient Markets Hypothesis (EMH), financial markets are efficient, that is, stock prices reflect all known public information; Secondly, the researched event is unexpected by the market, so this abnormal return can measure the degree of abnormal response of the stock price to the occurrence of the event or information disclosure; Third, there is no mixed effect of other events during the window of events.

The short-term event research method focuses on the announcement effect within a few days of the event's announcement date, which provides relevant evidence for investors to understand the company's decision on dividend distribution, mergers and acquisitions (e.g., Edmans, 2011; Deng

et al., 2013).

The main concepts of short-term event-study analysis are as follows:

Event date: The date the specific event occurred (t=0).

Event window: The time period during which the stock price involved in the event was examined ($[t_1, t_2]$), usually ($[t_1 < 0$)And($t_2 > 0$).

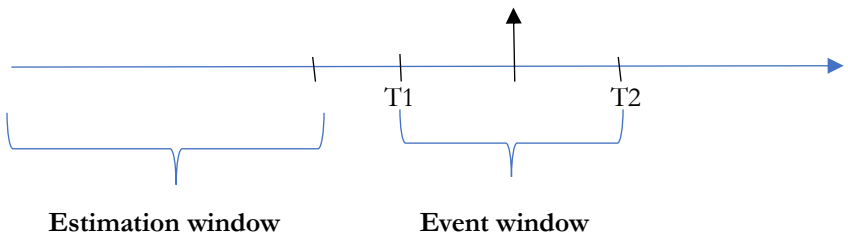
Estimation window: The estimation window is generally selected to be a period of time before the event occurs, usually from 210 trading days to 11 trading days before the event. The estimation window and the event window must not have intersected.

Normal Returns: stock return this event does not occur.

Abnormal Returns, Ars: The difference between the actual return rate of each stock and the normal return rate, the abnormal return rate can reflect the economic impact of the event.

Cumulative abnormal returns. CARs: The simple sum of the abnormal returns of each stock in the event window.

3.3.1 Models for Measuring Normal Performance



3.3.1.1 Constant-Mean-Return-Model

$$R_{i,t} = \mu_i + \xi_{i,t}$$

$$\mathrm{E}[\xi_{i,t}] = 0 \qquad Var[\xi_{i,t}] = \sigma^2_{\xi_i},$$

$R_{i,t}$, represent the period -t return on security i, $\xi_{i,t}$ represent the disturbance term, $\sigma_{\xi_i}^2$ represent the (i, i) element of Ω (Edmans, 2011).

3.3.1.2 The Capital Asset Pricing Model (CAPM)

$$\mathrm{E}R_i = R_f + \beta_i(ER_m - R_f)$$

$\mathrm{E}R_i$ represent expected return of investment. R_f represent the risk-free rate. β_i is beta of the investment. $(ER_m - R_f)$ equal to market risk premium (Fama, French, 2003).

3.3.1.3 Market Model

If the market is valid, an event is unexpected, and the occurrence of the event is related to the value of certain companies in the market, then the actual returns (ARs) of the company's stocks after the event are subtracted from the normal returns estimated by the statistical model The rate can get the abnormal return of the stock. According to the estimation steps of MacKinlay (1997), before the abnormal rate of return estimation, the window period of the event needs to be defined first. Usually, it includes the day of the event and the days before and after the event. Then define the estimation window and select the estimation model to calculate the expected rate of return. Taking the market model to estimate the expected rate of return, the abnormal rate of return (AR) can be expressed as:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \epsilon_{i,t}$$

$$\mathrm{E}\left[\epsilon_{i,t}\right] = 0 \qquad Var\left[\epsilon_{i,t}\right] = \sigma_{\epsilon_i}^2,$$

$R_{i,t}$ represent the period -t return on security i and, $R_{m,t}$ represent the market portfolio, $\epsilon_{i,t}$ represent the zero mean disturbance term. α_i , β_i and $\sigma_{\epsilon_i}^2$ represent the

parameters of the market model.

3.3.1.4 Market-adjusted-return Model

$$R_{i,t} = R_{m,t} + \epsilon_{i,t}$$

$R_{i,t}$ represent the period -t return on security i and, $R_{m,t}$ represent the market portfolio, $\epsilon_{i,t}$ represent the zero mean disturbance term. α_i and β_i represent the parameters of the market-adjusted-return model.

3.3.1.5 Fama-French Three Factor Model

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_1\left[R_{m,t} - R_{f,t}\right] + \beta_2 SMB_t + \beta_3(HML_t) + \epsilon_{i,t}$$

$R_{i,t}$ represent the total return of a stock or portfolio i at time t, $R_{f,t}$ represent the risk-free rate of return at time t. $R_{m,t}$ represent the total market portfolio return at time t. $R_{i,t} - R_{f,t}$ equal to expected excess return. $R_{m,t} - R_{f,t}$ equal to excess return on the market portfolio (index). SMB_t represent the size premium (small minus big). HML_t represent value premium (high minus low). α_i and $\beta_{i,2,3}$ represent the parameters of the Fama-French Three Factor model (Fama, 1997).

3.3.1.6 Fama-French Plus Momentum

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_1\left[R_{m,t} - R_{f,t}\right] + \beta_2 SMB_t + \beta_3(HML_t) + \beta_4(MOM_t) + \epsilon_{i,t}$$

$R_{i,t}$ represent the total return of a stock or portfolio i at time t, $R_{f,t}$ represent the risk-free rate of return at time t. $R_{m,t}$ represent the total market portfolio return at time t. $R_{i,t} - R_{f,t}$ equal to expected excess return. $R_{m,t} - R_{f,t}$ equal to excess return on the market portfolio (index). SMB_t represent the size premium (small minus big). HML_t

represent value premium (high minus low). MOM_t is described as the tendency for a stock to continue moving in the direction it moved last period. α_i and $\beta_{i,2,3,4}$ represent the parameters of the Fama-French Four Factor model.

3.3.1.7 Fama-French Five factor Model

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_1\left[R_{m,t} - R_{f,t}\right] + \beta_2 SMB_t + \beta_3(HML_t) + \beta_4(RMW_t) + \beta_5(CMA_t) + \epsilon_{i,t}$$

$R_{i,t}$ represent the total return of a stock or portfolio i at time t, $R_{f,t}$ represent the risk-free rate of return at time t. $R_{m,t}$ represent the total market portfolio return at time t. $R_{i,t} - R_{f,t}$ equal to expected excess return. $R_{m,t} - R_{f,t}$ equal to excess return on the market portfolio (index). SMB_t represent the size premium (small minus big). HML_t represent value premium (high minus low). RMW_t is the profitability represent the robust minus weak OP. CMA_t is a investment factor represent the conservative minus aggressive inv. α_i and $\beta_{i,2,3,4}$ represent the parameters of the Fama-French Five Factor model(Fama, French 2013).

3.3.1.8 Arbitrage Pricing Model (APT)

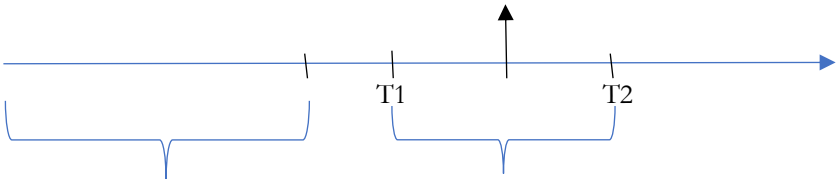
$$\widetilde{Ri} = \mu_i + \beta_{\mathrm{i}}\tilde{\delta} + \tilde{\varepsilon_{\mathrm{i}}}$$

$$\mathbf{E}[\tilde{\delta}] = \mathbf{0}, \qquad \mathbf{E}[\tilde{\varepsilon_{\mathrm{i}}}] = \mathbf{0}$$

$\widetilde{Ri}$ represent the realized return of asset i, μ_i represent the unconditional expected return, $\tilde{\delta}$ represent the vector of different risk factors, β_{i} is a vector denotes the impact every risk factor has on the asset return, $\tilde{\varepsilon_{\mathrm{i}}}$ is an error term summarizing the effects not covered by the model.

3.3.2 Measuring and Analysing Abnormal Returns

τ represent returns in event time. $\tau = 0$ denote the event date, $\tau = T_1 + 1$ to $\tau = T_2$ denote the event window, $\tau = T_0 + 1$ to $\tau = T_1$ represent the estimation window. Respectively, $L_1 = T_1 + T_0$ represent the length of the estimation window, $L_2 = T_2 + T_1$ represent the event window. If use the announcement to event, then $T_2 = T_1 + 1$ and $L_2 = 1$. If suitable, the post-event window will be from $\tau = T_2 + 1$ and $\tau = T_3$, its length is $L_3 = T_3 - T_2$. The figure shows the timing sequence.



Estimation window **Event window**

3.3 Hypothesis Development

3.3.1 Market Reaction to the Resignation of Independent Directors (IDs)

Firstly, independent directors are supposed to play monitoring role in the board, i.e., independent directors are supposed to monitor the misbehaviour of managers and reduce the agency cost given that these directors are independent. For example, Lin, Pope, and Young (2003) investigate the market reaction to the appointment of outside directors focusing on UK listed firms. They find that the market responds positively to the appointment of outside directors (e.g., independent directors) and particularly when the ownership of the board is low, and the outside directors possess strong monitoring incentives. Secondly, independent directors are supposed to play advising role in the board. The board diversity literature argues that the more diverse board, the more advising role they can play because difference independent directors have different background including educational background and work background. Thus, these independent directors with different background can enhance firm value based on their expertise they can provide and play advising role more effectively. If that is the case, the market should respond positively to the appointment of independent directors or respond negatively to the departure of independent directors as independent directors can bring value to the firm.

Alternatively, independent directors may not play monitoring role effectively if independent directors are not truly independent. For example, previous literature find that some outside directors have close relationship with management team. They are good friends of incumbent CEOs. If that is the case, outside directors cannot play monitoring role effectively. In addition,

outside directors may not play advising role effectively as well. This is because that these outside directors may not have industry experience and they do not have relevant knowledge on relevant practices in industry. Thus, they cannot play advising role effectively. If that is the case, there is no significant market response to the departure of independent directors, or even negatively to the departure of independent directors as independent directors are detrimental to the value of the firm.

Therefore, based on the above discussions, I propose the following hypotheses.

H1-0: Market response positively or no response to the resignation of independent directors (IDs)

H1-1: Market response negatively to the resignation of independent directors (IDs)

I examine the market reaction to the resignation of independent directors using event study. I will elaborate on the methodologies in section 3.5.

3.3.2 Market Reaction to the Resignation of Academic Independent Directors (AIDs)

Under the institutional background of China, the motivation for the independent directors to perform their duties is to avoid reputational and legal risks (Qingquan T et al., 2006; Kangtao Y et al., 2011). From the perspective of reputational risk, the independent director system of listed Chinese companies is mainly comprised by prominent figures in education or business fields. These people are usually very successful in their own areas of focus, which means that they also hold relativity high social status and good reputation in their respective industry. More than 76% firms have at least one academic professor as non-executive director in China. The advantages

include the following. Firstly, firms may appoint AIDs to play monitoring role using their expertise. Audretsch and Stephan (1996) and Audretsch and Lehmann (2006) argue that AIDs have the ability to process complex issues, which would benefit firm they serve. Secondly, firms may appoint AIDs to perform an advisory role instead of monitoring role. AIDs may enhance the advisory role of the board through introducing a wider range of ideas to the board (Anderson, Reeb, Upadhyay, Zhao, 2011). Science- and technology-based firms often appoint academic professors sitting on the board to remedy deficiencies in specialized knowledge. Thirdly, AIDs may contribute to greater coordination costs among directors. Knyazeva, Knyazeva, Raheja (2013) suggest that the coordination cost can outweigh the benefits of increased director heterogeneity at high level of board of directors. Fourth, firms may appoint AIDs because of social connections. Investors may value appointments of AIDs with social ties positively if the ties are viewed as facilitating recruitment of qualified directors or improving board effectiveness. Fifthly, firms may appoint AIDs because of their access to networks. AID networks may assist firms in facilitating access to external resources, such as bank loans (Guner, Malmendier, and Tate, 2008), social networks (Lynall, Golden, and Hillman, 2003) or knowledge transfer (Audretsch and Stephan, 1996). Appointing AIDs may provide firms with additional networking opportunities in attracting talent or access university resources. Finally, AIDs from prestigious universities may be viewed as enhancing firm's reputation or as a signal of firm quality (Audretsch and Stephan, 1996). Appointing AIDs from a prestigious institution can be perceived as a way restoring a firm's integrity and credibility. Overall, these arguments suggest that the market should respond positively when academic professors are appointed as independent directors or respond negatively when AIDs resign as independent directors.

However, firstly, investors may not value AIDs as effective monitors if AIDs are perceived as lacking industry experience or being less familiar with current business practices. Secondly, investors may view AIDs as being less qualified advisors or experts than executives or inside directors. Thirdly, potential advisory benefits from diverse perspectives are lower for independent directors (Liu, Wei, Xie, 2014). Fourth, investors may value appointments of AIDs with social ties negatively if the ties are viewed as decreasing the likelihood of board dissent (Hwang and Kim, 2009). Fifthly, investors may view socially connected AIDs to be less independent if firms are more likely to contribute to their universities. Finally, investors may not view university reputation as an adequate certification as a qualified director. Overall, there discussions suggest that there is no significant market reaction to the resignation of AIDs or even positive market reaction to the resignation of AIDs.

Therefore, based on the above discussion, I propose the following hypotheses.

H2-0: Market response positively to the resignation of academic independent directors (AIDs)

H2-1: Market response negatively to the resignation of academic independent directors (AIDs)

I examine the market reaction to the resignation of academic independent directors using event study. I will elaborate on the methodologies in section 3.5.

3.4 Data and Methodology

3.4.1 Data Sources

I create an academic director database based on information from CSMAR. The total number of observation left is 3,923. Finally, I only focus on academic directors rather than member of supervisory board and senior management team. The total number of observations left is 3,815.

The data used in this study includes ownership structure, corporate governance, firm characteristics and financial data. The main data source comes from the CSMAR financial database developed by the Shenzhen GTA Information Technology Co.

The source of the data, the information about the name of the university ranking is from Ministry of Education of the People's Republic of China. The announcement of the resignation of the independent director came from Shenzhen Stock Exchange and Shanghai Stock Exchange.

3.4.2 Sample Construction

The data in this article includes all the resignation announcements from the independent directors who sitting in the main board listed companies in China from 2005 to 2019.

During the manual collection process, I restricted the resignation announcements to only come from independent directors on the Shanghai Stock Exchange and Shenzhen Stock Exchange. In this way, the resignation information of independent directors with main control variables is obtained.

Figure 1: ID Resignations

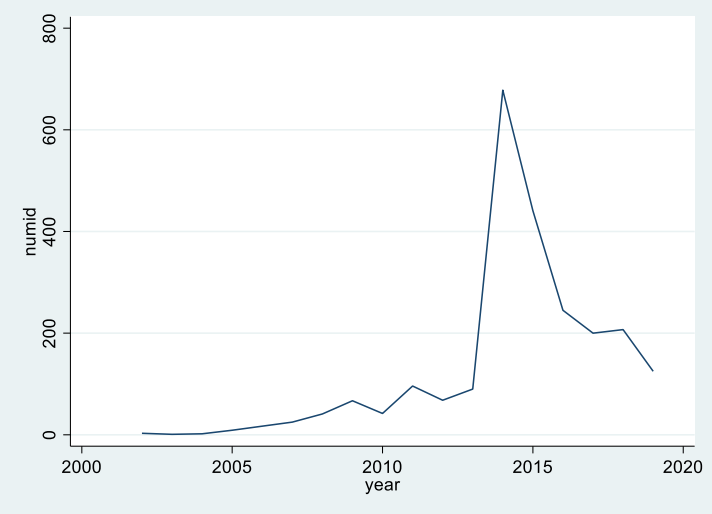
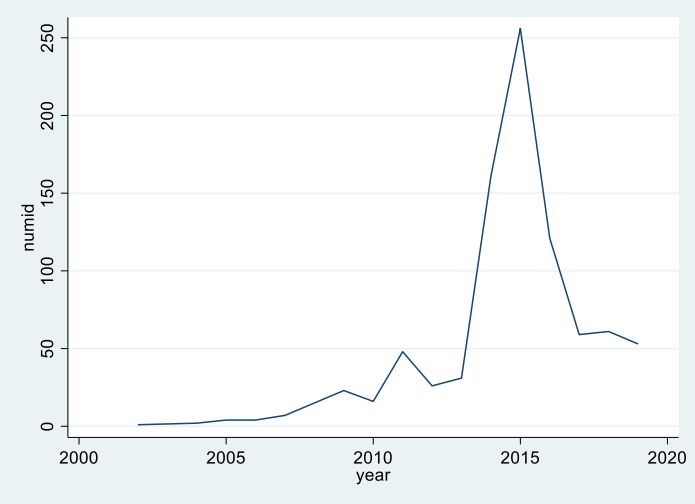


Figure 2: AID Resignations



3.4.3 Methodology

We use the standard Event Study approach to investigate the market reaction to the resignation of AID in China. Based on market model and Fama-French three factor model, I calculate the expected return. Based on expected return I calculated, I calculate the abnormal return and cumulative abnormal return over event window.

3.3.3.1 Market Model

Taking the market model to estimate the expected rate of return, the abnormal rate of return (AR)

can be expressed as:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \epsilon_{i,t}$$

$$\mathrm{E}[\epsilon_{i,t}] = 0 \qquad Var[\epsilon_{i,t}] = \sigma^2_{\epsilon_i},$$

Model 3

$R_{i,t}$ represent the period -t return on security i and, $R_{m,t}$ represent the market portfolio, $\epsilon_{i,t}$ represent the zero mean disturbance term. α_i, β_i and $\sigma^2_{\epsilon_i}$ represent the parameters of the market model.

3.4.3.2 Fama-French Three Factor Model

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_1[R_{m,t} - R_{f,t}] + \beta_2 SMB_t + \beta_3(HML_t) + \epsilon_{i,t}$$

Model 4

$R_{i,t}$ represent the total return of a stock or portfolio i at time t, $R_{f,t}$ represent the risk-free rate of return at time t. $R_{m,t}$ represent the total market portfolio return at time t. $R_{i,t} - R_{f,t}$ equal to expected excess return. $R_{m,t} - R_{f,t}$ equal to excess return on the market portfolio (index). SMB_t represent the size premium (small minus big). HML_t represent value premium (high minus low). α_i and $\beta_{i,2,3}$ represent the parameters of the Fama-French Three Factor model.

3.5 Empirical Results

3.5.1 Market Model

3.5.1.1 Market Reaction to the Resignation of Independent Directors (IDs)

In this section, I investigate the market reaction to the resignation of independent directors. I use the market model to calculate the expected return and subtract from realized return to calculate the abnormal return and cumulative abnormal return as well. The results are reported in Table 3.1.1.1(1).

Table 3.1.1.1(1) shows that the market responds positively on the date when independent directors resign. In particular, the abnormal return is 0.018% on the announcement date and is also significant at 1% significance level. Also, the abnormal return is positive and significant on the date one day before the announcement date, which indicates that there might be some information leakage before the event date. For the rest of days around the announcement date, there is no significant market reaction to the announcement of independent directors' resignation except on date T=2 and T=10.

Furthermore, I calculate various CARs over different windows. I find that all CARs are positive significant at 1% significance level. For example, CAR at window [-1,1] is 0.025% and significant at 1% significance level. CAR at window [-2,2] is 0.026% and also significant at 1% significance level. CAR at window [-20,20] is 0.029% and significant at 1% significance level. Figure 3 and 4 also show that the market responds positively on the date when independent directors resign. All these results on abnormal returns and on cumulative abnormal returns show that the market responds positively when independent directors resign their post as directors. These results

indicate that independent directors do not bring value to the firm and the departure of independent directors from a firm is viewed as good news to the investors. These results are consistent with H1-1 and against the H1-0.

Table 3.1.1.1(1): Abnormal Return (AR) on Resignation of Independent Director (ID)

This table presents the results on abnormal return about the resignation of independent directors from T=-5 to T=20. T=0 represents the event date and the model used to calculate the expected return is market model. The number of events is 1761.

	T= -5	T= -4	T= -3	T= -2	T= -1	T= 0	T= 1	T= 2	T= 3	T= 4	T= 5	T= 6	T= 7	T= 8	T= 9	T= 10	T= 15	T= 20
_cons	0.000	-0.001*	0.000	0.001	0.003***	**0.018****	0.000	0.002***	0.001	-0.000	0.001	-0.000	-0.001	0.000	0.000	0.002***	-0.000	-0.000
	(0.23)	(-1.67)	(0.84)	(0.89)	(3.42)	**(2.09)**	(0.35)	(2.83)	(1.00)	(-0.37)	(1.53)	(-0.44)	(-1.64)	(0.02)	(0.71)	(2.95)	(-0.02)	(-0.01)
N	1761	1761	1761	1761	1761	**1761**	1761	1761	1761	1761	1762	1762	1762	1762	1762	1761	1761	1761

Table 5.1.1.1(2): Cumulative Abnormal Return (CAR) on Resignation of Independent Director (ID)

This table presents the results on cumulative abnormal return about the resignation of independent directors from T=-5 to T=20. T=0 represents the event date and the model used to calculate the expected return is market model. The number of events is 1761.

	(1) [-1,1]	(2) [-2,2]	(3) [-3,3]	(4) [-4,4]	(5) [-5,5]	(6) [-10,10]	(7) [-15,15]	(8) [-20,20]
_cons	**0.025*****	**0.026*****	**0.027*****	**0.027*****	**0.027*****	**0.027*****	**0.028*****	**0.029*****
	(2.64)	(2.74)	(2.82)	(2.74)	(2.74)	(2.73)	(2.75)	(2.82)
N	1761	1761	1761	1761	1761	1761	1761	1761

Figure 3: Abnormal Return (AR) on Resignation of Independent Director (ID)

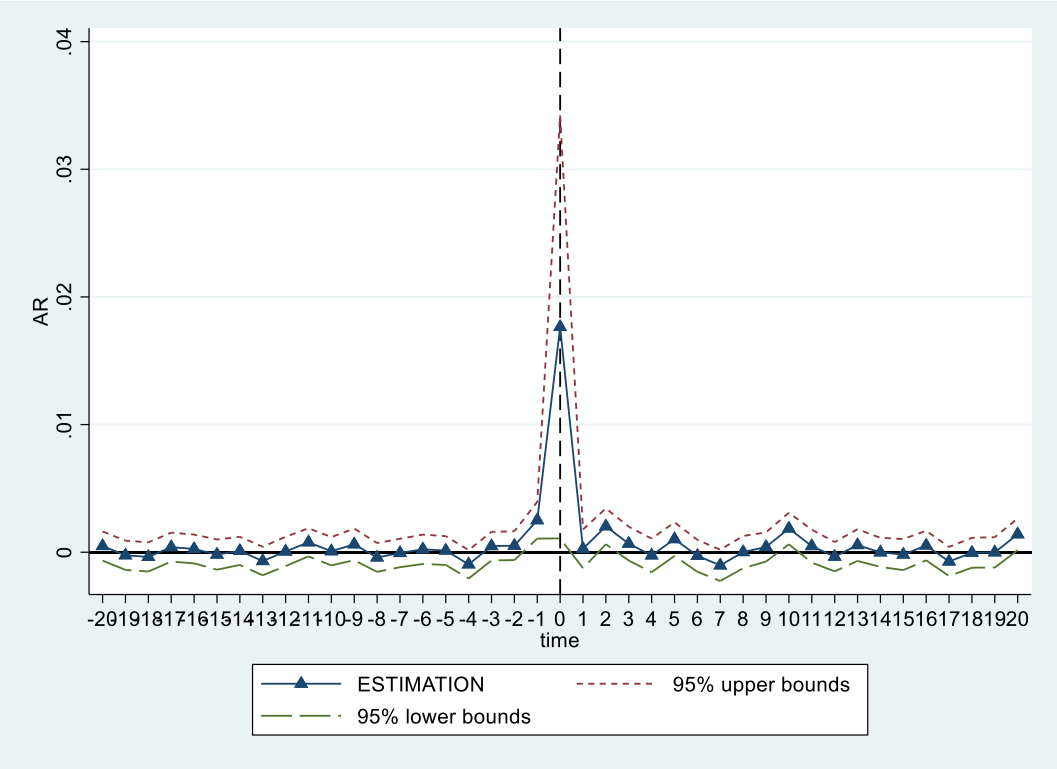
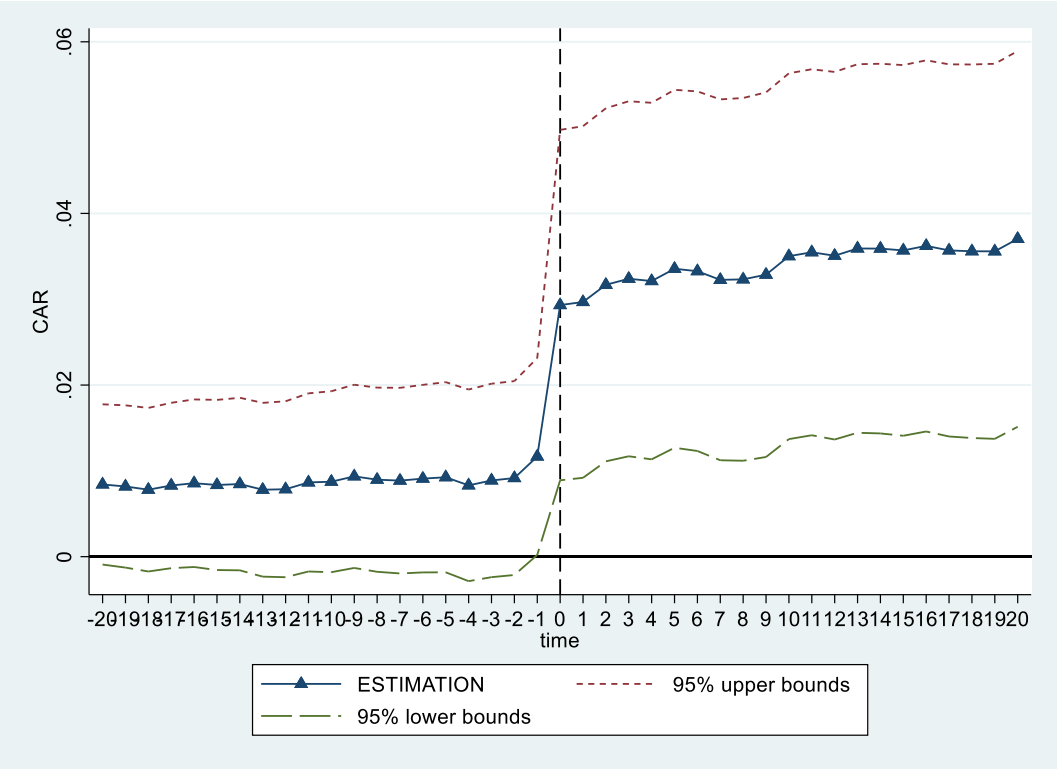


Figure 4: Cumulative Abnormal Return (CAR) on Resignation of Independent Director (ID)



3.5.1.2 Market Reaction to the Resignation of Academic Independent Directors (AIDs)

In this section, I investigate the market reaction to the resignation of AIDs. I use the market model to calculate the expected return and subtract from realized return to calculate the abnormal return and cumulative abnormal return as well. The results are reported in Table 3.5.1.2(1) and (2).

Table 3.5.1.2(1) shows that the market responds positively on the date when AIDs resign. In particular, the abnormal return is 0.004% on the announcement date and is also significant at 10% significance level. Also, the abnormal return is positive and significant on the date one day before the announcement date, which indicates that there might be some information leakage before the event date. For the rest of days around the announcement date, there is no significant market reaction to the announcement of AIDs' resignation except on date T=4 and T=10.

Furthermore, I calculate various CARs over different windows. I find that all CARs are positive significant at 1% significance level. For example, CAR at window [-1,1] is 0.008% and significant at 1% significance level. CAR at window [-2,2] is 0.008% and also significant at 5% significance level. CAR at window [-15,15] is 0.010% and significant at 10% significance level, which the significance is slightly weaker relative to the window at [-1, 1] and [-2,2].

Figure 5 and 6 also show that the market responds positively on the date when AIDs resign. All these results on abnormal returns and on cumulative abnormal returns show that the market responds positively when AIDs resign their post as directors. These results indicate that AIDs do not bring value to the firm and the departure of AIDs from a firm is viewed as good news to the investors. These results are consistent with H2-1 and against the H2-0.

Table 3.5.1.2(1) : Abnormal Return (AR) on Resignation of Academic Independent Director (AIDs)

This table presents the results on abnormal return about the resignation of independent directors from T=-5 to T=20. T=0 represents the event date and the model used to calculate the expected return is market model. The number of events is 743.

	T= -5	**T= -4**	**T= -3**	**T= -2**	**T= -1**	**T= 0**	**T= 1**	**T= 2**	**T= 3**	**T= 4**	**T= 5**	**T= 6**	**T= 7**	**T= 8**	**T= 9**	**T= 10**	**T= 15**	**T= 20**
_cons	0.001	-0.001	-0.000	-0.001	0.003**	**0.004***	-0.001	0.001	0.001	-0.002**	-0.000	-0.001	-0.001	0.000	0.001	0.002**	-0.000	-0.000
	(0.61)	(-0.59)	(-0.04)	(-0.60)	(2.37)	**(1.71)**	(-0.49)	(1.35)	(0.94)	(-2.16)	(-0.44)	(-0.92)	(-0.90)	(0.24)	(1.51)	(2.22)	(-0.27)	(-0.13)
N	743	743	743	743	743	**743**	743	743	743	743	743	743	743	743	743	743	743	743

Table 3.5.1.2(2): Cumulative Abnormal Return (CAR) on Resignation of Academic Independent Director (AIDs)

This table presents the results on cumulative abnormal return about the resignation of independent directors from T=-5 to T=20. T=0 represents the event date and the model used to calculate the expected return is market model. The number of events is 743.

	(1) [-1,1]	**(2) [-2,2]**	**(3) [-3,3]**	**(4) [-4,4]**	**(5) [-5,5]**	**(6) [-10,10]**	**(7) [-15,15]**	**(8) [-20,20]**
_cons	**0.008*** **	**0.008** **	**0.008** **	**0.008** **	**0.008***	**0.010** **	**0.010***	**0.008**
	(2.76)	(2.49)	(2.40)	(1.99)	(1.93)	(2.03)	(1.81)	(1.27)
N	743	743	743	743	743	743	743	743

Figure 5: Abnormal Return (AR) on Resignation of Academic Independent Director (AIDs)

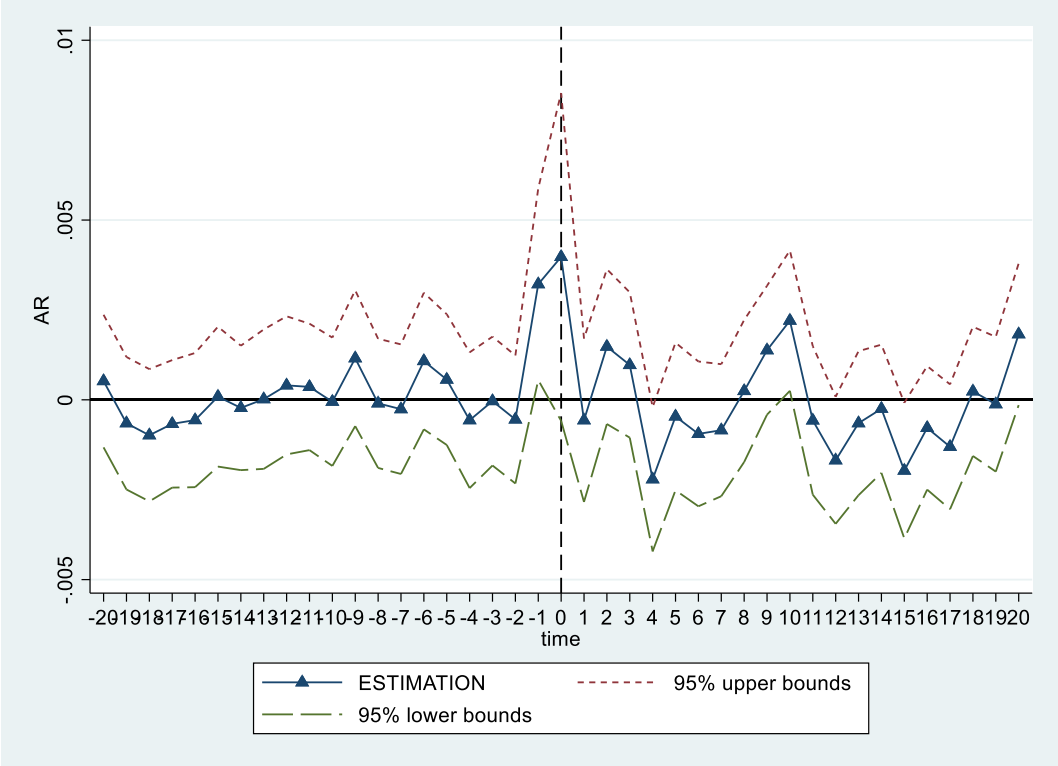
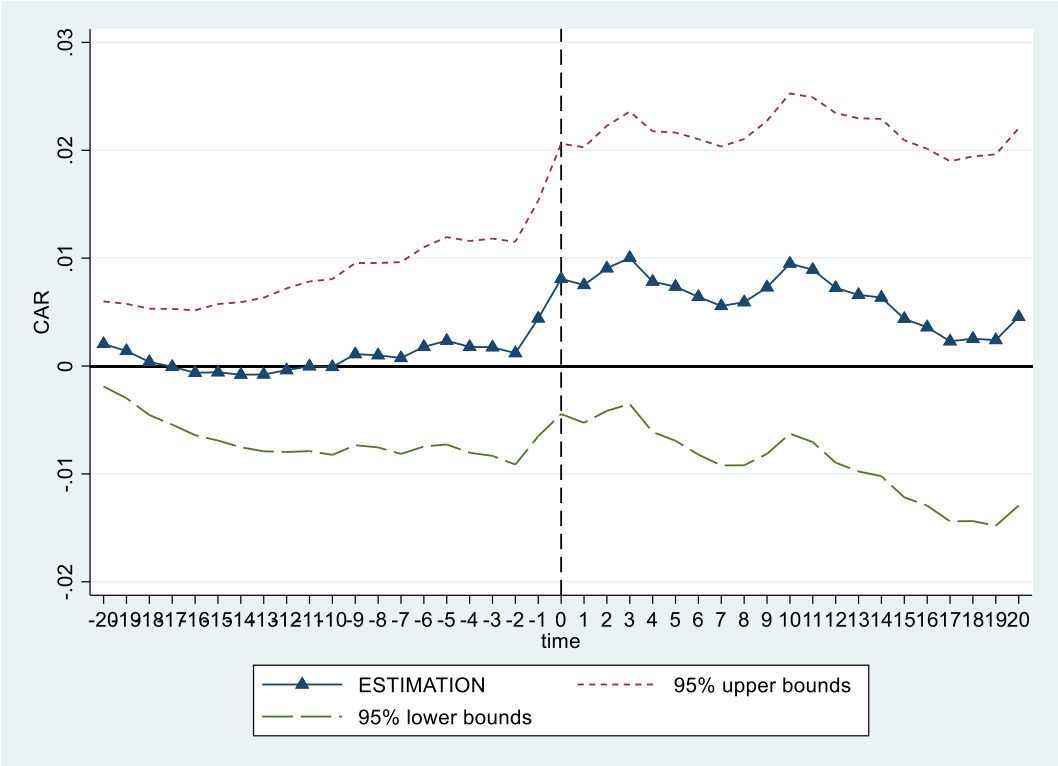


Figure 6: Cumulative Abnormal Return (CAR) on Resignation of Academic Independent Director (AIDs)



3.5.2 Fama-French Three Factor Model

3.5.2.1 Market Reaction to the Resignation of Independent Directors (IDs)

In this section, I investigate the market reaction to the resignation of independent directors. I use the Fama-French three factor model to calculate the expected return and subtract from realized return to calculate the abnormal return and cumulative abnormal return as well. The results are reported in Table 3.5.2.1(1) and (2).

Table 3.5.2.1(1) shows that the market responds positively on the date when independent directors resign. In particular, the abnormal return is 0.017% on the announcement date (i.e., T=0) and is also significant at 1% significance level. Also, the abnormal return is positive and significant on the date one day before the announcement date, which indicates that there might be some information leakage before the event date. For the rest of days around the announcement date, there is no significant market reaction to the announcement of independent directors' resignation except on date T=2 and T=10.

Furthermore, I calculate various CARs over different windows. I find that all CARs are positive significant at 1% significance level. For example, CAR at window [-1,1] is 0.025% and significant at 1% significance level. CAR at window [-2,2] is 0.025% and also significant at 1% significance level. CAR at window [-20,20] is 0.024% and significant at 1% significance level. Figure 7 and 8 also show that the market responds positively on the date when independent directors resign. All these results on abnormal returns and on cumulative abnormal returns show that the market responds positively when independent directors resign their post as directors. These results indicate that independent directors do not bring value to the firm and the departure of

independent directors from a firm is viewed as good news to the investors. These results are consistent with H1-1 and against the H1-0.

Overall, these results are similar to the results when using market model to calculate the expected return and accordingly the abnormal returns and cumulative abnormal returns.

Table 3.5.2.1(1): Abnormal Return (AR) on Resignation of Independent Director (ID)

This table presents the results on abnormal return about the resignation of independent directors from T=-5 to T=20. T=0 represents the event date and the model used to calculate the expected return is Fama-French three factor model. The number of events is 1761.

	T= -5	**T= -4**	**T= -3**	**T= -2**	**T= -1**	**T= 0**	**T= 1**	**T= 2**	**T= 3**	**T= 4**	**T= 5**	**T= 6**	**T= 7**	**T= 8**	**T= 9**	**T= 10**	**T= 15**	**T= 20**
_cons	-0.000	-0.001**	0.000	0.000	0.002***	**0.017****	-0.000	0.002**	0.000	-0.000	0.001	-0.001	-0.001*	-0.000	-0.000	0.002**	-0.000	-0.000
	(-0.06)	(-2.16)	(0.23)	(0.30)	(2.87)	**(2.04)**	(-0.30)	(2.06)	(0.38)	(-0.41)	(1.26)	(-0.98)	(-1.69)	(-0.42)	(-0.24)	(2.31)	(-0.19)	(-0.38)
N	1761	1761	1761	1761	1761	**1761**	1761	1761	1761	1761	1762	1762	1762	1762	1762	1761	1761	1761

Table 3.5.2.1(2): Cumulative Abnormal Return (CAR) on Resignation of Independent Director (ID)

This table presents the results on cumulative abnormal return about the resignation of independent directors from T=-5 to T=20. T=0 represents the event date and the model used to calculate the expected return is Fama-French three factor model. The number of events is 1761.

	(1) [-1,1]	**(2) [-2,2]**	**(3) [-3,3]**	**(4) [-4,4]**	**(5) [-5,5]**	**(6) [-10,10]**	**(7) [-15,15]**	**(8) [-20,20]**
_cons	**0.025****	**0.025*****	**0.025*****	**0.025****	**0.025****	**0.025****	**0.024****	**0.024****
	(2.54)	**(2.60)**	**(2.63)**	**(2.53)**	**(2.51)**	**(2.44)**	**(2.32)**	**(2.24)**
N	1761	1761	1761	1761	1761	1761	1761	1761

Figure 7: Abnormal Return (AR) on Resignation of Independent Director (ID)

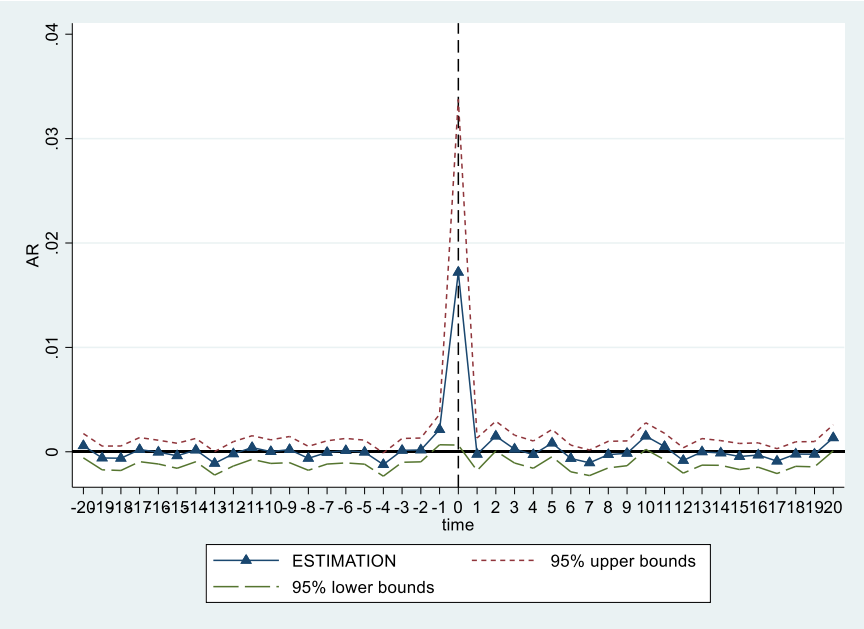
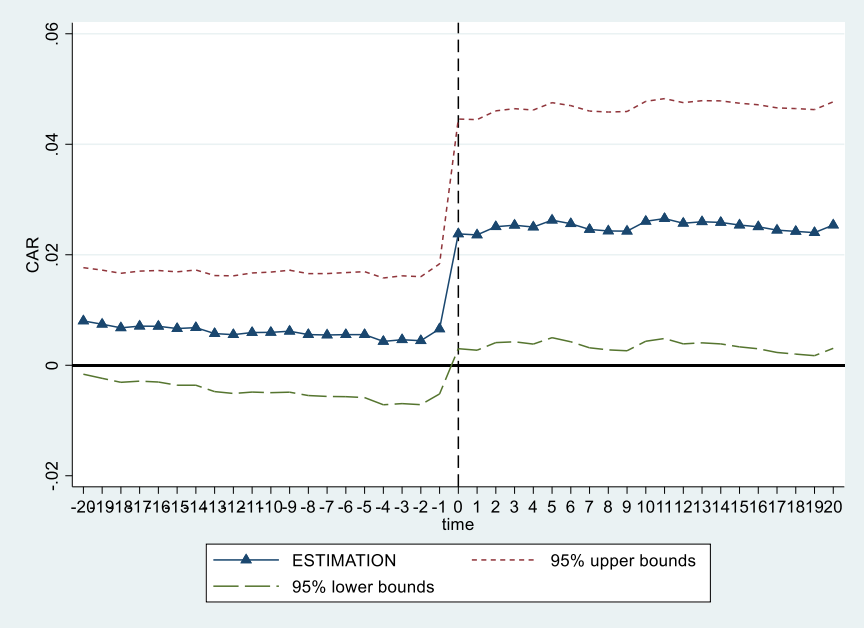


Figure 8: Cumulative Abnormal Return (CAR) on Resignation of Independent Director (ID)



3.5.2.2 Market Reaction to the Resignation of Academic Independent Directors (AIDs)

In this section, I investigate the market reaction to the resignation of AIDs. I use the Fama-French three factor model to calculate the expected return and subtract from realized return to calculate the abnormal return and cumulative abnormal return as well. The results are reported in Table 3.5.2.2(1) and (2).

Table 3.5.2.2(1) shows that the market responds positively on the date one day before AIDs resign. In particular, the abnormal return is 0.003% on the date of T=-1 and is also significant at 5% significance level. This indicates that there might be some information leakage before the event date. For the rest of days around the announcement date, abnormal returns are significant only on data T=9 and T=10. Overall, the results show that the market response positively when AIDs resign as independent directors.

Furthermore, I calculate various CARs over different windows. I find that almost all CARs are positive significant at 5% or 10% significance level. For example, CAR at window [-1,1] is 0.007% and significant at 5% significance level. CAR at window [-2,2] is 0.007% and also significant at 5% significance level. CAR at window [-10,10] is 0.008% and significant at 10% significance level, in which the significance is slightly weaker relative to the window at [-1, 1] and [-2,2].

Figure 9 and 10 also show that the market responds positively on the date around AIDs resign. All these results on abnormal returns and on cumulative abnormal returns show that the market responds positively when AIDs resign their post as independent directors. These results indicate that AIDs do not bring value to the firm and the departure of AIDs from a firm is viewed as good news to the investors. These results are consistent with H2-1 and against the H2-0.

Overall, these results are similar to the results when using market model to calculate the expected return and accordingly the abnormal returns and cumulative abnormal returns.

Table 3.5.2.2(1) : Abnormal Return (AR) on Resignation of Academic Independent Director (AIDs)

This table presents the results on abnormal return about the resignation of AIDs from T=-5 to T=20. T=0 represents the event date and the model used to calculate the expected return is Fama-French three factors. The number of events is 743.

	T=-5	**T=-4**	**T=-3**	**T=-2**	**T=-1**	**T=0**	**T=1**	**T=2**	**T=3**	**T=4**	**T=5**	**T=6**	**T=7**	**T=8**	**T=9**	**T=10**	**T=15**	**T=20**
_cons	-0.000	-0.001	-0.000	-0.001	**0.003****	0.004	-0.001	0.001	0.000	-0.002*	-0.000	-0.001	-0.001	0.000	0.002*	0.002*	-0.001	-0.000
	(-0.04)	(-0.77)	(-0.27)	(-1.12)	**(1.98)**	(1.50)	(-0.64)	(1.27)	(0.37)	(-1.67)	(-0.02)	(-1.01)	(-0.63)	(0.38)	(1.67)	(1.85)	(-0.63)	(-0.05)
N	743	743	743	743	**743**	743	743	743	743	743	743	743	743	743	743	743	743	743

Table 3.5.2.2(2): Cumulative Abnormal Return (CAR) on Resignation of Academic Independent Director (AIDs)

This table presents the results on cumulative abnormal return about the resignation of AIDs T=-5 to T=20. T=0 represents the event date and the model used to calculate the expected return is Fama-French three factor model. The number of events is 743.

	(1) [-1,1]	**(2) [-2,2]**	**(3) [-3,3]**	**(4) [-4,4]**	**(5) [-5,5]**	**(6) [-10,10]**	**(7) [-15,15]**	**(8) [-20,20]**
_cons	**0.007****	**0.007****	**0.007****	**0.006***	**0.006**	**0.008***	**0.007**	**0.003**
	(2.50)	**(2.15)**	**(2.03)**	**(1.66)**	**(1.50)**	**(1.66)**	**(1.25)**	**(0.50)**
N	743	743	743	743	743	743	743	743
r2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
r2_a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 9: AID (academic independent director) AR

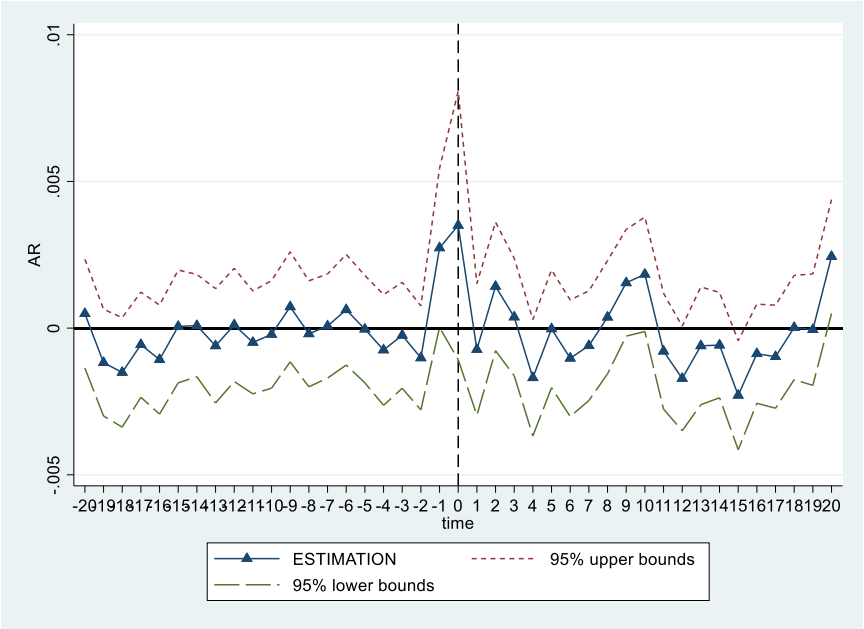
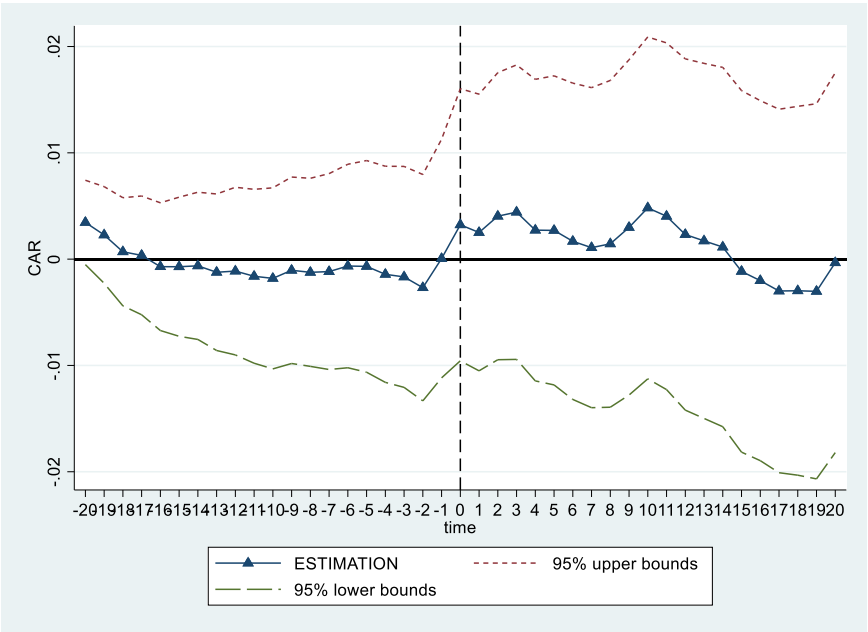


Figure 10: CAR AID



3.6 Discussion and Conclusion

This chapter investigates the market reaction to the resignation of independent directors and AIDs. The market will respond negatively if independent directors are beneficial to the firm and can bring value to the firm. Alternatively, the market will respond positively if independent directors are detrimental to the firm value. Same discussion applies to the resignation of AIDs.

Based on the sample I used in this study, I find that the market responds positively to the announcement of the departure of independent directors. In particular, the abnormal return is 0.018% on the announcement date (e.g., T=0) of departure of independent directors and is also significant at 1% significance level. I also find that the CARs over various windows are positive and significant at 1% significance level. CAR at window [-1,1] is 0.025% and significant at 1% significance level. Similar results exist about the market reaction to the resignation of AIDs.

The results about the market reaction to the resignation of independent directors and AIDs suggest that investors do not view independent directors (and AIDs) beneficial to the firm. These results are not consistent with the previous studies (e.g., White, Woidtke, Black and Schweitzer, 2014). There are several possible reasons why the findings based on this study are different from previous studies. Firstly, given that the sample used in this study focuses on Chinese listed firms, the institutional background of Chinese listed firms is different from firms in other countries. For example, the ownership structure in Chinese listed firms are concentrated and particularly concentrated in large shareholders, i.e., controlling shareholders. Thus, it is not supervised that many firms in China are controlled by controlling shareholders, including the appointment of

independent directors. If that is the case, the monitoring role played by independent directors will be reduced and limited as independent directors are not independent at all, i.e., the independent directors are closely associated with controlling shareholders and they cannot monitor the behavior of controlling shareholders (By the way, the main agency problem in firms with concentrated ownership structure is not the conflict between managers and outside investors, it is the conflict between controlling shareholders and minority shareholders). Furthermore, independent directors might represent the interest of controlling shareholders instead of minority shareholders. They may ignore the misbehavior of controlling shareholders when controlling shareholders act in their interest at the expense of minority shareholders, which mean that independent directors cannot play monitoring role effectively. Thus, investors would view the departure of independent directors (and AIDs) as good news and accordingly the market respond positively.

Secondly, the independent directors might not possess the relevant knowledge on business practices, particularly for academic independent directors. These directors are viewed as "vase directors"-they are beautiful, but not intelligent. They do not have relevant skills and expertise to be qualified independent directors. These directors are sitting on the board and just tick the box, particularly that these directors receive decent compensation from the firms they serve as independent directors. As an English proverb says, "gifts blind the eyes of the wise". This might be the case in Chinese listed firms.

Overall, the reasons mentioned above could be a future research direction if I can obtain relevant data.

Chapter 4 FEMALE DIRECTORS AND FIRM PERFORMANCE

4.1 Introduction

Many studies investigate the impact of female directors on firm performance. However, their findings are mixed. For example, Carter, Simkings, and Simpson (2003) and Campbell and Minguez-Vera (2008) find that the percentage of female directors has positive impact on firm performance. Levi, Li, Zhang (2014) find that female directors are beneficial in creating shareholder value through reducing bid premium. Liu, Wei, and Xie (2014) find a positive association between female directors and firm performance. On the contrary, Ahern and Dittmar (2012), Bohren and Staubo (2014) document that imposing the quota of 40% female directors sitting on the board is detrimental to the firm value. Adams and Ferreira (2009) find a positive association between female directors and corporate governance, such as attending board meeting and playing monitoring role. However, they did not find evidence about the positive association between female directors and firm performance. Triana, Miller, and Trzebiatowski (2013) show that board gender diversity is a double-edged sword as it depends on the firm performance and the power of female directors.

The aim of this chapter is to investigate the corporate governance role of female directors. To achieve this aim, this chapter focuses on these research questions. Firstly, what is the relationship between the presence of female directors and firm performance? Secondly, what is the relationship between the number and the percentage of female directors and firm performance? Thirdly, what is the relationship between the presence of female independent directors and firm performance? Fourthly, what is the relationship between the number and the percentage f female independent directors and firm performance.

To address these research questions, this study focuses on Chinese listed companies as in China, many listed companies have female directors or female independent directors. This study finds the following results. Firstly, the OLS estimation results about the relationship between female director and firm performance show that there is no relationship between the existence of female directors and firm performance. However, there is a significant positive association between the number of female directors and firm performance and there is a significant positive association between the percentage of female directors and firm performance. The OLS estimation results about the relationship between female independent directors and firm performance show that there is a significant

positive association between the existence of female independent directors, the number of female independent directors, and percentage of female independent directors and firm performance.

We use the fixed effect estimation and system GMM approach to address the endogeneity issue. The fixed effect estimation results show that there is no association between the presence of female directors, the number of female directors, the percentage of female directors and firm performance. There is a significant positive association between female independent directors, the number of female independent directors, the percentage of female independent directors and firm performance. However, the system GMM results show that there is no association between the presence of female (independent) directors, the number of female (independent) directors, the percentage of female (independent) directors and firm performance.

These findings indicate that different model specifications lead to different results. Given that OLS estimation results do not consider the endogeneity issue, the results are relatively weak. The fixed effect estimation results assume that there is a time-constant omitted variable bias, which is still a strong assumption. The system GMM results might be more reliable considering the dynamic characteristics of model, which means that the current firm performance is related to past firm performance. In general, 2SLS is used to solve problems with the identified endogenous variable. When it's not sure whether there is an endogenous variable, and yet a potential endogenous problem needs to be solved, system GMM can be applied instead. If some variables in the model are endogenous ones, the regression results of the ordinary panel would be biased. The dynamic panel method can eliminate the endogenous bias of the model and arrive at more effective estimation results.

In fact, all dynamic panels contain endogenous problems in them. In the dynamic panel data model, since the economic growth (1-phase lag) was used as the explanatory variable, this can lead to a correlation between dynamic terms and random disturbance terms, resulting in endogeneity. In addition, the introduction of economic growth lag into the model would lead to a correlation between unobserved individual effects from factors affecting economic growth and the explanatory variable, which would also result in endogeneity and mitigate the setting bias of the econometric model. Therefore, all dynamic panels and problems that can be transformed into dynamic panel problems are suitable for applying system GMM.

In addition, this chapter also investigates the market reaction to the resignation of female (independent) directors. This study uses both market model, Fama-French three factor, Fama-French five factor model to calculate the expected return and in return calculate the abnormal return and cumulative abnormal return. Both results show that there is no market reaction to the resignation of female (independent) directors. These results are consistent with the regression analysis results.

The rest of the paper is structured as follows. In Section 2, I present a brief literature review. In section 3, hypothesis development is presented. Section 4 describes the data and methodology. Section 5 presents our core empirical results. Endogeneity check is presented in Section 6. Further check on market reaction to the resignation of female (independent) directors is showed in section 7. Section 8 is the robustness check. Finally, discussion and conclusion are showed in Section 9.

4.2 Literature Review

4.2.1 Literature Review for Gender of Board

Adams. R. B, Ferreira. D (2009) investigate investigates whether gender diversity has impact on board room input, such as committee assignments and attendance, and whether the women directors sitting in board will affect the measures of company governance, such as compensation and turnover of CEO, and whether the gender diversity has an impact on firm performance. This paper finds gender diversity on board have important effect for board inputs-attendance behavior. They find that female directors are less likely to have attendance problems. When the proportion of female directors sitting in the board is growing, the attendance of male directors will be better than before. In addition, female directors are more likely to serve on the monitoring related committees than male directors, such as audit committee. Female directors have a significant impact on corporate governance. Gender-diversified boards are more likely to hold CEOs accountable for poor stock performance. Also, it has a significant impact on CEO turnover. But there is no statistical relationship between gender-diversification and CEO compensation. Furthermore, because female directors have under-represented in the remuneration committee, it is less involved in participation in the decision of CEO compensation. This article finds that gender diversity of board is good for firms having weak shareholder rights. It will increase the company's value due to the additional monitors from gender diverse board. Regarding to firms with strong shareholder rights, gender diversity board has negative impact on company, such as making decisions on mergers and acquisitions. There are two potential endogeneity problems for relevant studies in this area. One of them comes from the unobservable features in different companies and the other one is the endogenous problem due to the reverse causal relationship. This article solves these problems. This is the first paper studying the effect of gender diversity on board input, corporate governance, and firm performance; This paper provides evidence about effect of gender diversity in the governance of the board of directors. This article also provides some evidence against the tokenism of female directors.

Liu. Y, Wei. Z. B, Xie. F. X (2014) investigates the relationship between female directors and firm performance. By focusing on Chinese listed companies, they find that female directors have significant influence on ROA and ROE. In particularly, executive directors with female gender have larger impact on firm performance compared

to independent directors with female gender. In addition, boards including three or more female directors have larger influence on firm performance compared to boards including one or two female directors. Thirdly, this study finds that female directors only play roles in legal person-controlled companies, play no roles in state-controlled companies. Overall, female directors have significant impact on firm value in publicly traded companies in China.

Sila. V, Gonzalez. A, and Hagendorff. J (2016) investigate the effect of gender diversity to company risk. This study examines the relationship between boardroom gender diversity and firm risk. To address endogeneity issues coming from unobservable factors and reverse causality, this study uses a dynamic panel system GMM estimator to estimate the dynamic relationship between boardroom gender diversity and firm risk. They find no significant association between boardroom gender diversity and firm risk. They also use difference-in-difference methods, and various risk measures, their results are still the same. They contribute the existing literature by extending relevant studies to non-financial companies. In addition, by focusing on firm risk, this study contributes the literature by presenting that firm risk is not a channel through which gender diversity have impact on firm value.

Gul, Srinidhi, and Ng (2011) investigate the relationship between board gender diversity and informativeness of stock prices. It finds that stock prices of firms with gender-diverse boards reflect more firm-specific information. In addition, the relationship is stronger for firms with weak corporate governance which indicates that gender-diverse boards could act as a substitute mechanism for corporate governance. Finally, board gender diversity improves stock price informativeness through the mechanism of increased public disclosure in large firms and by encouraging private information collection in small firms.

Adams and Funk (MS2012) find that female and male directors differ systematically in their core values and risk attitudes, but in ways that differ from gender differences in the general population. In addition, they find that female directors are more benevolent and universally concerned but less power oriented than male directors. Furthermore, female directors are less tradition and security oriented than their male counterparts. Overall, these results indicate that having a woman on the board need not lead to more risk-averse decision making

Ahern and Dittmar (QJE2012) find a large negative impact of the mandated board changes on firm value. Event study results show that on the days around the announcement, it finds that the average industry-adjusted stock

return for firms with no female directors was -3.54%, relative to -0.02% for firms with at least one female director. IV estimation indicates that the quota caused a significant negative effect on Tobin's Q. These results indicate that the constraint imposed by the law had a large negative effect on firm value, which is consistent with the argument that the massive reorganization of corporate boards is not benefit to a firm. In addition, it investigates how the quota influenced the characteristics of the board. It finds that the new female directors are substantially different than the existing male directors. In particular, the new female directors had significantly less CEO experience and were younger, more highly educated, and more likely to employed as a nonexecutive manager, relative to retained male directors. In addition, it investigates the mechanism through which the board may have affected firm value. It finds that the quota led firms to increase in size, undertake more acquisitions, increase leverage, and reduce cash holdings. Finally, given that the quota leads to negative effect to firm value, it expects that some firms may avoid the law by becoming a private limited firm or incorporate outside of Norway. It finds that there is a significant negative association between the probability of delisting after the quota is passed and the number of women on the board before the quota is passed.

Bohren and Staubo (JCF2014) document that after the law of gender balance mandated and passed, half the firms exit to an organizational form not exposed to the law. This suggests that forced gender balance is costly. Also, these costs are firm specific. Furthermore, certain unexposed firms hesitate to become exposed. Overall, the results indicate that mandatory gender balance man produce firms with inefficient organizational forms or inefficient boards.

Cumming, Leung, Rui (AMJ2015) investigate the relationship between board gender diversity and securities fraud. They find that board gender diversity can operate as a significant moderator for the frequency of fraud. In addition, the stock market response to fraud from a more gender-diverse board is significantly less pronounced. Also, women are more effective in male-dominated industries in reducing both the frequency and severity of fraud.

Adams and Kirchmaier (AER2016P&P) document that the fraction of women on the board is lower for firms in the STEM and Finance sectors than in the non-STEM sector. In addition, women are most underrepresented on the boards in the natural resources and mining, manufacturing, financial activities sectors. Moreover, women are less represented on corporate boards in STEM and Finance sector suggests that women's underrepresentation in STEM sector may get worse at higher levels of the corporate hierarchy.

Agarwal, Qian, Reeb, Sing (AER2016_P&P) show that the participation of women in golf game significantly increases the likelihood of their serving on a board of directors. In addition, they find that the likelihood increased by 116 percent if a woman plays a golf relative to a woman does not play a golf. These results suggest that becoming part of the boys' network increase a woman's chance of serving on the board.

Faccio, Marchica, and Mura (JCF2016) examines the relationship between CEO gender and corporate risk-taking. It finds that firms run by female CEOs have lower leverage, less volatile earnings, and a higher chance of survival than firms run by male CEOs. Firms transferred from male to female CEOs are associated with significant reductions in corporate risk-taking. In addition, the risk-avoidance behavior leads to distortion in capital allocation process.

Kim and Starks (AER2016) investigates the mechanism through which board gender diversity improve firm value. It finds that female who are appointed as corporate directors diversify the set of boards' expertise more than do their male counterparts. In addition, female bring unique skills to corporate boards. These findings indicate that female directors can enhance boards' advisory effectiveness and has the potential to increase firm value.

Chen, Leung, Georgen (JCF2017) examine the relationship between female independent directors and dividend policy. They find that firms with a larger fraction of female directors on their board have greater dividend payouts. In addition, board gender composition significantly increases the dividend payout only for firms with weak corporate governance, which indicates that female directors use dividend payout policy as a corporate governance mechanism.

Evgeniou and Vermaelen (JCF2017) investigates the relationship between board gender diversity and share buyback. It finds that board gender diversity increases the likelihood that firms buy its shares back. However, the long-term excess returns are significantly smaller when there is larger female representation on the board. This result is consistent with the hypothesis that board gender diversity makes it more likely that firms buy back shares to reduce agency costs of free cash flow. In addition, board gender diversity improves the quality of public information disclosure, share buyback is less driven by marketing timing.

Liu (JCF2018) investigates the relationship between board gender diversity and corporate environmental violations. It finds that firms with greater board gender diversity are less often sued for environmental infringements. In

addition, female CEO are significantly associated with reduced environmental litigation, but only in firms with low female board representation. These findings indicate a corporate governance role of female leaders.

Ye, Deng, Liu, Szewczyk, and Chen (JCF2019) investigate the relationship between board gender diversity and payout policy across many countries around the world. They find that the impact of board gender diversity on dividend payout is significant positive. In addition, both the number and the proportion of female directors sitting on the board affect the likelihood and the level of dividend payouts. They also find that the effect of board gender diversity on dividend payouts is smaller in good institutional environments. They also investigate the impact of financial crisis, national culture, family-controlled ownership, and state-controlled ownership on the relationship between board gender diversity and payout policy. These results imply that board gender diversity promotes effective corporate governance.

Greene, Intintoli, and Kahle (JCF2020) investigate the market reaction to the first mandated board gender diversity quota in US- requiring public firms headquartered in California to have at least one female director by the end of 2019 and at least two (three) female directors on five (six or more) member boards by the end of 2021. They find a significantly and economically negative stock market reaction to this announcement. This result indicates that mandated board gender diversity is a cost to a firm.

Overall, the findings of these previous literature are mixed. For example, some literature has found that female directors have a good effect on firm (Carter, Simkings, and Simpson 2003; Campbell, Minguez-Vera 2008; Levi, Li, Zhang 2014; Liu, Wei, and Xie 2014). On the contrary, some literature has found that female directors sitting on the board is detrimental to the firm (Ahern, Dittmar 2012; Bohren, Staubo 2014; Adams, Ferreira 2009; Triana, Miller, and Trzebiatowski 2013). In addition, many existing studies investigating the corporate governance role of female (independent) directors focus on developed countries, such as US, few studies focus on developing countries, such as China. One of literature focus in China have some problems, firstly, it uses ROA to dependent variables, not Tobin's. but Tobin's Q can better express firm performance. Secondy, the methodology of this paper use FE, FE with l, FE with IV, Arellano-bond. But normal use system GMM or matching firms PSM. In this thesis, attention will be paid to these problems. Hence, this chapter will better investigate the effect of female directors on firm performance.

4.2.2 Review Relevant Theories about Female Directors

Except the theories related to independent directors (agency theory, stakeholder theory and resource dependence theory). Token status theory is important to female directors. Token status theory argue that female or minorities in top management team are regarded as "tokens" and the images of female token managers are more linked to femininity rather than to the qualities of leadership (Kanter, 1977; Liu, Wei and Xie, 2014). Thus, firms with only one female director sitting on the board as directors might not perform better.

On the other hand, the critical mass theory argues that "one is a token, two is a presence, and three is a voice" (Kristie, 2011). This critical mass theory suggests that firms with more female directors perform better as more female directors can voice their opinions compared to firms with less female directors. Therefore, based on this discussion, I propose the following hypothesis.

4.3 Hypothesis Development

4.3.1 The Relationship between the Presence of Female Directors (FD), Female CEO and Firm Performance

Resource dependence theory argue that resources are key to organizational success. To survive, businesses depend on resources in their external environments and firms can connect with external entities having these resources. Pfeffer and Salancik (1978) point out that firms can benefit from external resources through advising and counselling, legitimacy, and communication etc. For example, female leaders, due to their different experience and opinion, are better equipped to connect their firms to female customers, female in the labour markets and society at large. Hillman, Shropshire, and Cannella (2007) investigate board gender diversity focusing U.S. firms and they find that firms with more board gender diversity can accrue these benefits. Agency theory pointed out that to reduce agency cost, one approach is to enhance monitoring by the board of directors. Empirical evidence shows that female directors tend to be more active in playing monitoring role. For example, Adams and Ferreira (2009) find that female directors have better attendance records than male directors and female directors are more likely to join monitoring committees. These results suggest that boards with female directors allocate more effort to monitoring.

In addition, Adams and Ferreira (2009) argue that the effect of board gender diversity on corporate decisions depends on firm's corporate governance quality. In particular, board gender diversity can be detrimental to firm value in well-governed firms due to unnecessary *over-monitoring role*. However, Gul, Srinidhi, and Ng (2011) argue that gender-diverse boards are beneficial to the firm and can remedy the weak governance of the firm through having gender-diverse boards. Liu, Wei, and Xie (2014) focus on Chinese listed companies and argue that over-monitoring is less likely in China and firms with gender-diverse boards have positive effect on firm performance because of the substitute effect of gender-diverse board. Overall, based on these discussions, this chapter will better investigate the effect of female directors on firm performance. I propose the following hypotheses.

H1-0: There is no association between the presence of female directors (FDs) and firm performance.

H1-1: There is positive association between the presence of female directors (FDs) and firm performance.

As exposited in the introduction, I examine the relationship between FDs and firm performance using pooled

OLS regression model (Gormley and Matsa 2014). We will elaborate on the methodologies in chapter 4.5.1.

4.3.2 The Relationship between the Presence of Female Independent Directors (FIDs) and Firm Performance

The main tasks for independent directors are advising and monitoring. In terms of monitoring role, female independent directors can play more effective role compared to male independent directors. Adams and Ferreira (2009) find that female directors have better attendance records than male directors and female directors are more likely to join monitoring committees. Particularly, female directors are more likely to join in audit, nominating, and corporate governance committees and are less likely to join in compensation committees.

On the other hand, female independent directors can be just rubber stamps. That explains why people call these independent directors "rubber-stamps." Independent directors are supposed to play the role of keeping large shareholders and top managers in check, as the owners of the firm (e.g., controlling shareholders in China) tend to act in their own interest or make wrong managerial judgments. However, independent directors seem to raise few objections at board meetings, and they are often called as "rubber-stamps" or "vase independent directors" (flower vase are often used to describe ladies who are beautiful, but not intelligent or not experts in that area) in China. Thus, if female independent directors are vase independent directors, they cannot play monitoring role effectively and therefore have no effect on firm performance. Based on these discussions, I propose the following hypotheses.

H2-0: There is no association between the presence of female independent directors (FIDs) and firm performance.

H2-1: There is positive association between the presence of female independent directors (FIDs) and firm performance.

As exposited in the introduction, I examine the relationship between FIDs and firm performance using pooled OLS regression model (Gormley and Matsa 2014). We will elaborate on the methodologies in chapter 4.5.2.

4.3.3 The Relationship between the Number of Female Directors (FDs) on Firm Performance

Token status theory argue that female or minorities in top management team are regarded as "tokens" and the images of female token managers are more linked to femininity rather than to the qualities of leadership (Kanter, 1977; Liu, Wei and Xie, 2014). Thus, firms with only one female director sitting on the board as directors might not perform better. However, the critical mass theory argues that "one is a token, two is a presence, and three is a voice" (Kristie, 2011). This critical mass theory suggests that firms with more female directors perform better as more female directors can voice their opinions compared to firms with less female directors.

On the other hand, may be ineffective when there is more than one female director sitting in the board. Greene (2020) investigate the market reaction to the first mandated board gender diversity quota in US- requiring public firms headquartered in California to have at least one female director by the end of 2019 and at least two (three) female directors on five (six or more) member boards by the end of 2021. They find a significantly and economically negative stock market reaction to this announcement. This result indicates that mandated board gender diversity is a cost to a firm.

Therefore, based on this discussion, I propose the following hypothesis.

H3-0: There is no association between the number of female directors (FDs) and firm performance.

H3-1: There is positive association between the number of female directors (FDs) and firm performance.

As exposited in the introduction, I examine the relationship between the number of FDs (the variables name is **FD_NUM**, in table 4.5.1(2)) and firm performance using pooled OLS regression model (Gormley and Matsa 2014). We will elaborate on the methodologies in chapter 4.5.1.

4.3.4 The Relationship between the Number of Female Independent Directors (FIDs) on Firm Performance

Similar to the above argument about the relationship between the number of female directors and firm

performance, because of token status theory, firms with only one female director sitting on the board as independent directors might not perform better. On the other hand, because of the critical mass theory, firms with more female independent directors perform better as more female independent directors can voice their opinions compared to firms with less female independent directors. Therefore, based on this discussion, I propose the following hypotheses.

H4-0: There is no association between the number of female independent directors (FIDs) and firm performance.

H4-1: There is positive association between the number of female independent directors (FIDs) and firm performance.

As exposited in the introduction, I examine the relationship between the number of FDs (the variables name is **FID_NUM**, in table 4.5.2) and firm performance using pooled OLS regression model (Gormley and Matsa 2014). We will elaborate on the methodologies in chapter 4.5.2.

4.4 Data and Methodology

4.4.1 Data

The data of this paper included board composition data, firm value and other firm characteristics data. This data base shows the all Chinese listed companies from 1999 to 2016. The source of data in this paper mainly comes from CSMAR data base. CSMAR data base is produced by Shenzhen GTA Data Company in China. In addition, some data comes from both Shenzhen Stock Exchange and Shanghai Stock Exchange website and post annual reports. Moreover, some data are crosschecked and manually collected from some officially designated and public websites, such as www.cninfo.com.cn. The original data have 33065 data that includes all listed companies on Shenzhen and Shanghai stock exchanges. Initiate start, I clean the original data. At first, I deleted all companies from growth enterprise market, small and medium enterprise board and new over-the-counter market. Because the regulatory is different between those companies and the companies from main-board market. In China, main-board market has higher quality monitor than second-board market, financial data from the annually report will be more realistic. In addition, I use data from main-board market listed companies, received the data have 24234. Next, I delete all missing variables, and received the number of firm year observations is 21921. To reduce the influence of extreme values, all variables are subsequently winsorized at the 1st and 99th percentiles. Table 1 was shown all list and definition of variables.

Table 4.4.1 Summary Statistics of All Variables

This table presents summary statistics of all variables used in this chapter. The sample period is from 1999 to 2016 and the sample consists of all listed firms listed on Main board in Chinese stock exchange excluding financial firms. Variable definitions are provided in Appendix. All variables are winsorized at the 1st and 99th percentile values.

Variable	Obs	Mean	Std. Dev.	Min	Max
TQ_01	21,921	1.4912	1.4007	0.2076	9.3257
TQ_02	21,921	1.5622	1.4318	0.2504	9.5126
TQ_03	21,921	1.5204	1.3019	0.3978	9.0613
TQ_04	21,921	2.0597	1.7904	0.4398	11.4594
MTB_01	21,921	1.8438	1.4067	0.6513	9.6565
MTB_02	21,921	1.9154	1.4429	0.6960	9.9100
MTB_03	21,921	1.8730	1.3070	0.8558	9.3858
MTB_04	21,921	2.4141	1.8144	0.8608	11.9779
ROA	21,921	0.0239	0.0733	-0.3613	0.1922
ROE	21,921	0.0463	0.2310	-1.3574	0.9245
FD_NUM	21,921	1.2384	1.1751	0.0000	8.0000
FD_PER	21,921	0.1143	0.1079	0.0000	0.7000
FD_DUM	21,921	0.6934	0.4611	0.0000	1.0000
D1_FD	21,921	0.3475	0.4762	0.0000	1.0000
D2_FD	21,921	0.2130	0.4094	0.0000	1.0000
D3_FD	21,921	0.1329	0.3395	0.0000	1.0000
FID_NUM	21,921	0.4310	0.6565	0.0000	5.0000
FID_PER	21,921	0.0394	0.0605	0.0000	0.4444
FID_DUM	21,921	0.3494	0.4768	0.0000	1.0000
D1_FID	21,921	0.2802	0.4491	0.0000	1.0000
D2_FID	21,921	0.0625	0.2421	0.0000	1.0000
D3_FID	21,921	0.0090	0.0946	0.0000	1.0000
FCEO_DUM	17,768	0.0548	0.2275	0.0000	1.0000
FS	21,921	8440.0000	20500.0000	173.0000	150000.0000
LEV	21,921	0.5190	0.2273	0.0822	1.5135
TANGI	21,921	0.2777	0.1885	0.0023	0.7781
GROWTH	21,921	0.2203	0.7005	-0.7381	5.1940
CAPEX	21,921	0.0517	0.0542	0.0001	0.2623
BS	21,921	9.3039	2.0932	0.0000	19.0000
IN_DIR	21,921	2.8817	1.2420	0.0000	8.0000

4.4.2 Methodology

4.4.2.1 The relationship between female directors (FDs) and firm performance (OLS)

$$FIRM\_PERFORMANCE_{it} = \beta_0 + \beta_1 FD\_NUM_{it} + \beta_2 FD\_PER_{it} + \beta_3 FD\_DUM_{it} + \beta_4 FCEO\_DUM_{it} + \beta_5 FS_{it} + \beta_6 LEV_{it} + \beta_7 TANGI_{it} + \beta_8 GROWTH_{it} + \beta_9 CAPEX_{it} + \beta_{10} BS_{it} + \beta_{11} IN\_DIR_{it} + \beta_{12} DUM\_YEAR_{it} + \beta_{13} DUM\_IND_{it} + \lambda_t + \varepsilon_{it}$$

Model 5

In this model, the dependent variable is **FIRM_PERFORMANCE** and is measured by Tobin's Q. Tobin's Q is defined as market value of total assets divided by book value of total assets. The book value of total assets is obtained from the balance sheet, while the market value of total assets is the sum of the market value of total equity plus the market value of total debt. However, there is either no market of debt or no liquid market of debt, hence there is no market value of total debt. Following the previous literature about calculating Tobin's Q, I use the book value of total debt as the proxy of market value of the total debt. Regarding the market value of total equity, given that there were/are tradable shares and non-tradable shares in listed companies in China, the market value of tradable shares is equal to the product of the market price of tradable shares and the total number of tradable shares. Regarding the market value of non-tradable shares, I use the following methods to calculate market value of non-tradable shares: 1) using the 20% of tradable shares as the proxy of market price of corresponding non-tradable shares, the corresponding Tobin's Q is referred as **TQ_01**; 2) using the 30% of tradable shares as the proxy of market price of corresponding non-tradable shares, the corresponding Tobin's Q is referred as **TQ_02,** 3) using the net asset value per share as the proxy of market value of corresponding non-tradable shares, the corresponding Tobin's Q is referred as **TQ_03**; 4) using the market price of tradable shares as the proxy of market price of corresponding non-tradable shares, the corresponding Tobin's Q is referred as **TQ_04**. Using 20% and 30% of tradable shares as the proxy of market price pf corresponding non-tradable shares are due to the illiquidity discount (e.g., Cai, Hillier and Wang, 2015). In addition, I also use the net asset value per share as another proxy due to illiquidity discount (net asset value per share can be obtained directly from balance sheet). Finally, I use the market price of tradable shares as the proxy of market price of non-tradable shares.

The key independent variable is **FD_NUM** represents the number of Female directors on board. **FD_PER** represents the percent of woman directors on board. **FD_DUM** is a dummy variable and equals one when the board have female director sitting in the board, the dummy variables equals 0 when the board does not have female director sitting in the board. **FCEO_DUM** is a dummy variable, the dummy variable equals one when the board have female CEO sitting in the board, the dummy variables equals zero when the board not have female CEO sitting in the board. **FS** indicates firm size which is defined as total assets. **LEV** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **TANGI** indicates tangibility which is defined as the ratio of fixed assets to total assets. **GROWTH** indicates sales growth which is defined as the percentage change in sales year-on-year. **CAPEX** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **IN_DIR** indicates the number of independent directors on the board. Thus, our regression model (1) use OLS regression, I use λ_t to control for macroeconomic yearly fluctuations.

4.4.2.2 The relationship between female independent directors (FIDs) on firm performance (OLS)

$$FIRM\_PERFORMANCE_{it} = \beta_0 + \beta_1 FID_NUM_{it} + \beta_2 FID\_PER_{it} + \beta_3 FID\_DUM_{it} + \beta_4 FS_{it} + \beta_5 LEV_{it} + \beta_6 TANGI_{it} + \beta_7 GROWTH_{it} + \beta_8 CAPEX_{it} + \beta_9 BS_{it} + \beta_{10} IN\_DIR_{it} + \beta_{11} DUM\_YEAR_{it} + \beta_{12} DUM\_IND_{it} + \lambda_t + \varepsilon_{it}$$

Model 6

In this model, the dependent variable is **FIRM_PERFORMANCE** and is measured by Tobin's Q. The key independent variable is **FID_NUM** is the number of independent female director on board. **FID_PER** is the percent of female independence director on board. **FID_DUM** is a dummy variable, the dummy variables equals one when the board has independent female director sitting in the board, the dummy variables equals zero when

the board does not have independent female director sitting in the board. The control variables are some with before.

4.5 Empirical Results

In this section, I investigate the influence of female directors on firm performance. In particular, I investigate the relationship between the presence of female directors and firm performance, the relationship between the presence of female independent directors and firm performance, the relationship between the number of female directors and firm performance, and the relationship between the number of female independent directors and firm performance.

Correlation matrix suggests that the multicollinearity issue is not a big problem as the correlations among independent variables are not very high.

4.5.1 The Relationship between Female Directors (FDs) and Firm Performance

The table 4.5.1(2) shows that the existence of female directors has no impact on firm performance as the coefficient on female director is not significant. However, the coefficient on the number of female directors is positive and also significant at 5% significance level. The coefficient on the percentage of female directors is also positive and significant at 5% significance level. These results indicate that the number of female directors and the percentage of female directors have positive impact on firm performance. Agency theory pointed out that to reduce agency cost, one approach is to enhance monitoring by the board of directors. Empirical evidence shows that female directors tend to be more active in playing monitoring role. For example, Adams and Ferreira (2009) find that female directors have better attendance records than male directors and female directors are more likely to join monitoring committees. These results suggest that boards with female directors allocate more effort to monitoring.

In addition, I find that when CEO is a female, firm performs better. This might because female CEOs are more diligent and considerate. Resource dependence theory argue that resources are key to organizational success. To survive, businesses depend on resources in their external environments and firms can connect with external entities having these resources. Pfeffer and Salancik (1978) point out that firms can benefit from external resources through advising and counselling, legitimacy, and communication etc. For example, female leaders, due to their

different experience and opinion, are better equipped to connect their firms to female customers, female in the labour markets and society at large. Hillman, Shropshire, and Cannella (2007) investigate board gender diversity focusing U.S. firms and they find that firms with more board gender diversity can accrue these benefits. Liu, Wei, and Xie (2014) focus on Chinese listed companies and argue that over-monitoring is less likely in China and firms with gender-diverse boards have positive effect on firm performance because of the substitute effect of gender-diverse board.

The coefficients of some control variables are consistent with the expectation. For example, small firms perform better because they have more investment opportunities. Firms with high leverage perform better because of the tax shield benefits.

However, I need to careful in interpreting the results here as the analysis did not consider the endogeneity issue. I will discuss this later.

Table 4.5.1(1) Correlation Matrix of All Independent Variables

	FD_NUM	FD_PER	FD_DUM	D1_ FD	D2_ FD	D3_ FD	FID_NUM	FID_PER	FID_DUM	D1_FID	D2_FID	D3_FID	FCEO_DUM	FS	LEV	TANGI	GROWTH	CAPEX	BS	IN_DIR
FD_NUM	1																			
FD_PER	0.9394	1																		
FD_DUM	0.7008	0.7046	1																	
D1_ FD	-0.148	-0.1103	0.4853	1																
D2_ FD	0.3372	0.3507	0.346	-0.3796	1															
D3_ FD	0.7529	0.6888	0.2603	-0.2857	-0.2037	1														
FID_NUM	0.5959	0.5494	0.4367	-0.073	0.207	0.446	1													
FID_PER	0.5542	0.5838	0.4338	-0.0524	0.2158	0.4025	0.9577	1												
FID_DUM	0.5233	0.5039	0.4873	0.0245	0.2432	0.3344	0.8961	0.8901	1											
D1_FID	0.3152	0.3197	0.4149	0.1384	0.1994	0.1289	0.557	0.5784	0.8514	1										
D2_FID	0.3688	0.3398	0.1718	-0.1885	0.1233	0.349	0.6173	0.5873	0.3525	-0.1611	1									
D3_FID	0.2564	0.1884	0.0635	-0.0697	-0.0497	0.2439	0.3905	0.3066	0.1303	-0.0037	-0.0247	1								
FCEO_DUM	0.0187	0.0164	0.0143	0.0042	-0.0007	0.0144	0.0156	0.0134	0.0125	0.0064	0.0085	0.0117	1							
FS	-0.041	-0.0784	-0.0329	-0.0024	-0.0055	-0.0346	0.0139	-0.0124	0.0138	0.0069	0.0165	-0.0071	0.0076	1						
LEV	0.0118	0.0085	0.0264	0.0103	0.0314	-0.0165	0.018	0.0173	0.0272	0.0266	0.0054	-0.0142	0.0192	0.1503	1					
TANGI	-0.0579	-0.0718	-0.0566	-0.002	-0.0303	-0.0375	0.0367	0.0251	0.031	0.0162	0.0228	0.0186	-0.0333	0.0415	-0.0084	1				
GROWTH	0.0106	0.0027	0.0058	0.0048	-0.005	0.0072	0.001	-0.0027	0.0034	0.0063	-0.0075	0.0029	0.0107	0.0073	0.0174	-0.0626	1			
CAPEX	-0.0532	-0.0638	-0.0446	0.0081	-0.0336	-0.0315	-0.0012	-0.0071	0.0034	0.0056	0.0002	-0.0126	-0.0363	0.0434	-0.1176	0.3095	0.033	1		
BS	0.0993	-0.0781	0.065	-0.0217	0.0372	0.0739	0.0308	-0.0725	0.0201	0.0044	0.0241	0.0237	-0.0432	0.1143	0.0114	0.1295	-0.0134	0.1116	1	
IN_DIR	0.1053	0.0147	0.1	0.0052	0.0518	0.0661	0.2506	0.1983	0.2664	0.2141	0.1117	0.0522	0.0419	0.2331	0.1155	0.0278	-0.0065	0.0305	0.3494	1

FD_NUM represents the number of female directors on board. **FD_PER** represents the percent of woman directors on board. **FD_DUM** is a dummy variable and equals one when the board have female director sitting in the board, the dummy variables equals 0 when the board does not have female director sitting in the board. **D1_ FD** is a dummy variable, equals one when the board has one female director sitting in the board, and zero otherwise. **D2_ FD** is a dummy variable, equals one when the board has two female directors sitting in the board, and zero otherwise. **D3_ FD** is a dummy variable, equals one when the board has three female directors sitting in the board, and zero otherwise. **FID_NUM** is the number of independent female director on board. **FID_PER** is the percent of female independence director on board. **FID_DUM** is a dummy variable, the dummy variables equals one when the board has independent female director sitting in the board, the dummy variables equals zero when the board does not have independent female director sitting in the board. **D1_FID** is a dummy variable, equals one when the board has one independent female director sitting in the board, and zero otherwise. **D2_FID** is a dummy variable, equals one when the board has two independent female directors sitting in the board, and zero otherwise. **D3_FID** is a dummy variable, equals one when the board has three independent female directors sitting in the board, and zero otherwise. **FCEO_DUM** is a dummy variable, the dummy variable equals one when the board have female CEO sitting in the board, the dummy variables equals zero when the board not have female CEO sitting in the board. **FS** indicates firm size which is defined as total assets. **LEV** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **TANGI** indicates tangibility which is defined as the ratio of fixed assets to total assets. **GROWTH** indicates sales growth which is defined as the percentage change in sales year-on-year. **CAPEX** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **IN_DIR** indicates the number of independent directors on the board.

Table 4.5.1(2): The Relationship Between the Presence of Female Directors (FDs), Female CEO, and Firm Performance (OLS)

This table presents the results of OLS regression with industry and year fixed effect. The dependent variable is TQ_01. The sample period is from 1999 to 2016 and the sample consists of all listed firms listed on Main board in Chinese stock exchange excluding financial firms. Variable definitions are provided in Appendix. All variables are winsorized at the 1st and 99th percentile values. Robust standard errors are provided in parentheses.

	(3)	(1)	(2)	(7)
VARIABLES	**Model**	**Model**	**Model**	**Model**
FD_DUM	0.009			
	(0.019)			
FD_NUM		**0.041*** **		
		(0.009)		
FD_PER			**0.372*** **	
			(0.090)	
FCEO_DUM				**0.079***
				(0.046)
BS	-0.044***	-0.047***	-0.043***	-0.049***
	(0.005)	(0.005)	(0.005)	(0.006)
IN_DIR	-0.029**	-0.028**	-0.028**	-0.025*
	(0.013)	(0.013)	(0.013)	(0.015)
FS	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
LEV	0.462***	0.462***	0.462***	0.471***
	(0.073)	(0.073)	(0.073)	(0.082)
TANGI	0.049	0.052	0.051	0.036
	(0.059)	(0.059)	(0.059)	(0.067)
GROWTH	-0.018	-0.019	-0.018	-0.031*
	(0.017)	(0.017)	(0.017)	(0.018)
CAPEX	-0.412**	-0.410**	-0.411**	-0.495***
	(0.162)	(0.161)	(0.161)	(0.189)
DUM_YEAR	Yes	Yes	Yes	Yes
DUM_IND	Yes	Yes	Yes	Yes
Constant	1.567***	1.568***	1.531***	1.667***
	(0.078)	(0.078)	(0.079)	(0.091)
Observations	21,921	21,921	21,921	17,768
R-squared	0.231	0.232	0.231	0.235
Adj. R-squared	0.229	0.230	0.230	0.233
Standard Errors	1.229	1.228	1.229	1.268

4.5.2 The Relationship between Female Independent Directors (FIDs) and Firm Performance

Table 4.5.2 shows that the coefficient on dummy variable FID_DUM is positive and significant at 1% significance level. This result indicates that firms with female independent directors perform better compared to firms without female independent directors. This result is consistent with the finding of Adams and Ferreira (2009) as they find that female directors have better attendance records than male directors and female directors are more likely to join monitoring committees, although they do not find a positive association between firms with female directors and firm performance.

Table 4.5.2 also shows that the more female independent directors sitting on the board, the firm performs better. The coefficients on dummy variable FID_NUM and on dummy variable FID_PER are positive and significant at 1% significant level. Token status theory argue that female or minorities in top management team are regarded as "tokens" and the images of female token managers are more linked to femininity rather than to the qualities of leadership (Kanter, 1977; Liu, Wei and Xie, 2014). Thus, firms with only one female director sitting on the board as directors might not perform better.

On the other hand, the critical mass theory argues that "one is a token, two is a presence, and three is a voice" (Kristie, 2011). This critical mass theory suggests that firms with more female directors perform better as more female directors can voice their opinions compared to firms with less female directors.

The coefficients of some control variables are consistent with the expectation. For example, small firms perform better because they have more investment opportunities. Firms with high leverage perform better because of the tax shield benefits.

However, I need to careful in interpreting the results here as the analysis did not consider the endogeneity issue. I will discuss this later.

Table 4.5.2 The Relationship Between Female Independent Directors (FID) and Firm Performance (OLS)

This table presents the results of OLS regression with industry and year fixed effect. The dependent variable is TQ_01. The sample period is from 1999 to 2016 and the sample consists of all listed firms listed on Main board in Chinese stock exchange excluding financial firms. Variable definitions are provided in Appendix. All variables are winsorized at the 1st and 99th percentile values. Robust standard errors are provided in parentheses.

	(6)	(4)	(5)
VARIABLES	**Model**	**Model**	**Model**
FID_DUM	**0.053*** **		
	(0.019)		
FID_NUM		**0.030** **	
		(0.015)	
FID_PER			**0.426*** **
			(0.164)
BS	-0.043***	-0.044***	-0.043***
	(0.005)	(0.005)	(0.005)
IN_DIR	-0.032**	-0.032**	-0.031**
	(0.014)	(0.014)	(0.014)
FS	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)
LEV	0.461***	0.462***	0.462***
	(0.073)	(0.073)	(0.073)
TANGI	0.042	0.042	0.041
	(0.059)	(0.059)	(0.059)
GROWTH	-0.018	-0.018	-0.018
	(0.017)	(0.017)	(0.017)
CAPEX	-0.419***	-0.416**	-0.418***
	(0.161)	(0.162)	(0.161)
DUM_YEAR	Yes	Yes	Yes
DUM_IND	Yes	Yes	Yes
Constant	1.575***	1.574***	1.564***
	(0.078)	(0.078)	(0.078)
Observations	21,921	21,921	21,921
R-squared	0.231	0.231	0.231
Adj. R-squared	0.229	0.229	0.229
Standard Errors	1.227	1.227	1.229

4.6 Endogeneity Check

4.6.1 Fixed Effect estimation

We use the fixed effect estimation to address endogeneity issue coming from time-constant omitted variable. The models about the relationship between female directors and firm performance and the relationship between female independent directors and firm performance as follows.

The Relationship Between Female Directors and Firm Performance (Fixed Effect)

$$FIRM\_PERFORMANCE_{it} = \beta_0 + \beta_1 FD\_NUM_{it} + \beta_2 FD\_PER_{it} + \beta_3 FD\_DUM_{it} + \beta_4 FCEO\_DUM_{it} + \beta_5 FS_{it} + \beta_6 LEV_{it} + \beta_7 TANGI_{it} + \beta_8 GROWTH_{it} + \beta_9 CAPEX_{it} + \beta_{10} BS_{it} + \beta_{11} IN\_DIR_{it} + \beta_{12} DUM\_YEAR_{it} + \alpha_i + \lambda_t + \varepsilon_{it}$$

Model 7

In this model, the dependent variable is **FIRM_PERFORMANCE** and is measured by Tobin's Q. The key independent variable is **FD_NUM** represents the number of Female directors on board. **FD_PER** represents the percent of woman directors on board. **FD_DUM** is a dummy variable and equals one when the board have female director sitting in the board, the dummy variables equals 0 when the board does not have female director sitting in the board. **FCEO_DUM** is a dummy variable, the dummy variable equals one when the board have female CEO sitting in the board, the dummy variables equals zero when the board not have female CEO sitting in the board. The control variables are same with before. Thus, our regression model uses Fixed effect regression.

Effect of Female Independent Directors (FID) on Firm Performance (Fixed Effect)

$$FIRM_PERFORMANCE_{it} = \beta_0 + \beta_1 FID_NUM_{it} + \beta_2 FID\_PER_{it} + \beta_3 FID\_DUM_{it} + \beta_4 FS_{it} + \beta_5 LEV_{it} + \beta_6 TANGI_{it} + \beta_7 GROWTH_{it} + \beta_8 CAPEX_{it} + \beta_9 BS_{it} + \beta_{10} IN\_DIR_{it} + \beta_{11} DUM\_YEAR_{it} + \alpha_i + \lambda_t + \varepsilon_{it}$$

Model 8

In this model, the dependent variable is **FIRM_PERFORMANCE** and is measured by Tobin's Q. The key independent variable is **FID_NUM** is the number of independent female director on board. **FID_PER** is the percent of female independence director on board. **FID_DUM** is a dummy variable, the dummy variables equals one when the board has independent female director sitting in the board, the dummy variables equals zero when the board does not have independent female director sitting in the board. The control variables are same with before. Thus, our regression model uses Fixed effect regression.

Table 6.6.1.(1) shows that there is no relationship between female directors and firm performance. Firstly, the coefficient on dummy variable FD_DUM is not significant at 10% significance level. Secondly, the coefficients on variable FD_NUM and FD_PER are not significant at 10% significance level. In addition, the coefficient on variable FCEO_DUM is not significant at 10% significance level.

The coefficients of some control variables are consistent with the expectation. For example, small firms perform better because they have more investment opportunities. Firms with high leverage perform better because of the tax shield benefits. Firm with more capital expenditure performance better because more investment has been taken and eventually this will be transformed to enhance firm performance. Firms with more tangibility assets perform better.

Table 4.6.1 (2) shows that female independent directors have positive influence on firm performance. Firstly, the coefficient on dummy variable FID_DUM is positive and significant at 10% significance level. Secondly, the coefficients on variable FID_NUM and FID_PER are positive and significant at 10% significance level.

Similar to female directors' results, the coefficients of some control variables are consistent with the expectation. For example, small firms perform better because they have more investment opportunities. Firms with high leverage perform better because of the tax shield benefits. Firm with more capital expenditure performance better because more investment has been taken and eventually this will be transformed to enhance firm performance. Firms with more tangibility assets perform better.

Table 4.6.1(1): The Relationship Between Female Directors (FDs), Female CEO, and Firm Performance (Fixed Effect)

This table presents the results of FE regression with industry and year fixed effect. The dependent variable is TQ_01. The sample period is from 1999 to 2016 and the sample consists of all listed firms listed on Main board in Chinese stock exchange excluding financial firms. Variable definitions are provided in Appendix. All variables are winsorized at the 1st and 99th percentile values. Robust standard errors are provided in parentheses.

	(3)	(1)	(2)	(7)
VARIABLES	**Model**	**Model**	**Model**	**Model**
FD_DUM	-0.017			
	(0.019)			
FD_NUM		0.013		
		(0.008)		
FD_PER			0.065	
			(0.091)	
FCEO_DUM				-0.013
				(0.046)
BS	-0.024***	-0.026***	-0.025***	-0.033***
	(0.006)	(0.006)	(0.006)	(0.007)
IN_DIR	0.004	0.003	0.003	0.015
	(0.015)	(0.015)	(0.015)	(0.017)
FS	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
LEV	0.511***	0.511***	0.511***	0.523***
	(0.046)	(0.046)	(0.046)	(0.053)
TANGI	0.295***	0.296***	0.295***	0.242***
	(0.066)	(0.066)	(0.066)	(0.076)
GROWTH	-0.052***	-0.053***	-0.052***	-0.062***
	(0.010)	(0.010)	(0.010)	(0.011)
CAPEX	1.020***	1.019***	1.019***	1.131***
	(0.157)	(0.157)	(0.157)	(0.184)
DUM_YEAR	Yes	Yes	Yes	Yes
Constant	1.047***	1.040***	1.035***	1.154***
	(0.073)	(0.072)	(0.073)	(0.086)
Observations	21,921	21,921	21,921	17,768
R-squared	0.278	0.278	0.278	0.282
Number of stkcd	1,589	1,589	1,589	1,550
Adj. R-squared	0.221	0.221	0.221	0.212

Table 4.6.1(2): The Relationship Between Female Independent Directors (FIDs) and Firm Performance (Fixed Effect)

This table presents the results of FE regression with industry and year fixed effect. The dependent variable is TQ_01. The sample period is from 1999 to 2016 and the sample consists of all listed firms listed on Main board in Chinese stock exchange excluding financial firms. Variable definitions are provided in Appendix. All variables are winsorized at the 1st and 99th percentile values. Robust standard errors are provided in parentheses.

	(4)	(5)	(6)
VARIABLES	**Model**	**Model**	**Model**
FID_NUM	**0.026***		
	(0.014)		
FID_PER		**0.430*****	
		(0.151)	
FID_DUM			**0.058*****
			(0.019)
BS	-0.025***	-0.024***	-0.025***
	(0.006)	(0.006)	(0.006)
IN_DIR	0.001	0.001	-0.000
	(0.015)	(0.015)	(0.015)
FS	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)
LEV	0.512***	0.512***	0.512***
	(0.046)	(0.046)	(0.046)
TANGI	0.293***	0.292***	0.293***
	(0.066)	(0.066)	(0.066)
GROWTH	-0.053***	-0.052***	-0.053***
	(0.010)	(0.010)	(0.010)
CAPEX	1.019***	1.017***	1.016***
	(0.157)	(0.157)	(0.157)
DUM_YEAR	Yes	Yes	Yes
Constant	1.042***	1.035***	1.042***
	(0.072)	(0.072)	(0.072)
Observations	21,921	21,921	21,921
R-squared	0.279	0.279	0.279
Number of stkcd	1,589	1,589	1,589
Adj. R-squared	0.221	0.221	0.221

4.6.2 System GMM

In general, 2SLS is used to solve problems with the identified endogenous variable. When it's not sure whether there is an endogenous variable, and yet a potential endogenous problem needs to be solved, system GMM can be applied instead. If some variables in the model are endogenous ones, the regression results of the ordinary panel would be biased. The dynamic panel method can eliminate the endogenous bias of the model and arrive at more effective estimation results.

In fact, all dynamic panels contain endogenous problems in them. In the dynamic panel data model, since the economic growth (1-phase lag) was used as the explanatory variable, this can lead to a correlation between dynamic terms and random disturbance terms, resulting in endogeneity. In addition, the introduction of economic growth lag into the model would lead to a correlation between unobserved individual effects from factors affecting economic growth and the explanatory variable, which would also result in endogeneity and mitigate the setting bias of the econometric model. Therefore, all dynamic panels and problems that can be transformed into dynamic panel problems are suitable for applying system GMM.

There are the following judgement criteria in system GMM:

1. Over-identification, Hansen test, H0: IV is joint effective. Therefore, it should not be significant; that is, the p-value should be no less than 0.1. If it is significant, this means that the null hypothesis is rejected and IV is not jointly effective. However, if the p-value is greater than 0.25, this means there are too many IV, and thus the effect of the Hansen test is compromised. Therefore, the proper range of p-value should be 0.1-0.25. Sargan test is also an over-identification test. In most cases, the Hansen test results are reported while the Sargan test results are not. The statistics of the Sargan test are not robust but are highly immune to the excessive number of IV. In contrast, the statistics of the Hansen test are robust but are affected by the excessive number of IV.

2. Autocorrelation in errors. Generally, autocorrelation in first-differenced errors is allowed, which means that the p-value of AR (1) should be less than 0.1. However, autocorrelation in second-differenced errors is not allowed, which means the p-value of AR (2) should be greater than 0.1. Zhang Haiyang (2015) explained the use of the system GMM in detail.

$$y_{it} = \alpha_1 + k_1 y_{it-1} + k_2 y_{it-2} + \beta \boldsymbol{X_{it}} + \gamma \boldsymbol{Z_{it}} + \theta \boldsymbol{D_{it}} + \eta_i + \epsilon_{it}$$
t=1999, 2000, …, 2016.

Model 9

y_{it} is **FIRM_PERFORMANCE** and is measured by Tobin's Q. $\boldsymbol{X_{it}}$ include **FD_NUM** represents the number of Female directors on board. **FD_PER** represents the percent of woman directors on board. **FD_DUM** is a dummy variable and equals one when the board have female director sitting in the board, the dummy variables equals 0 when the board does not have female director sitting in the board. **FID_NUM** is the number of independent female director on board. **FID_PER** is the percent of female independence director on board. **FID_DUM** is a dummy variable, the dummy variables equals one when the board has independent female director sitting in the board, the dummy variables equals zero when the board does not have independent female director sitting in the board. **FCEO_DUM** is a dummy variable, the dummy variable equals one when the board have female CEO sitting in the board, the dummy variables equals zero when the board not have female CEO sitting in the board. $\boldsymbol{Z_{it}}$ include **FS** indicates firm size which is defined as total assets. **LEV** indicates leverage which is defined as the ratio of total long-term liabilities to total assets. **TANGI** indicates tangibility which is defined as the ratio of fixed assets to total assets. **GROWTH** indicates sales growth which is defined as the percentage change in sales year-on-year. **CAPEX** indicates capital expenditure defined as the total capital expenditure divided by total assets. **BS** indicates board size which is defined as the total number of directors on the board. **IN_DIR** indicates the number of independent directors on the board. Thus, our regression model (1) use system GMM.

Table 4.6.2 (1) shows that there is no relationship between female directors and firm performance. Firstly, the coefficient on dummy variable FD_DUM is not significant at 10% significance level. Secondly, the coefficients on variable FD_NUM and FD_PER are not significant at 10% significance level. In addition, the coefficient on variable FCEO_DUM is significant at 10% significance level, but the sign is negative, which means that the presence of female CEO is detrimental to firm performance. Table 4.6.2 (2) shows that the presence, the number, and the percentage of female independent directors have no influence on firm performance as all coefficients on relevant variables are insignificant at 10% significant level.

Regarding AR (1), AR (2), this is related to the test of second-order serial correlation. For the valid of system GMM estimates, the residual of the first difference (i.e., AR (1)) should be correlated, but the residual of the second difference (i.e., AR (2)) should be no correlated. My results are consistent with these expectations.

Regarding Hansen test, it tests the over-identification. The system GMM estimator uses multiple lags as instruments, which means that the system is over-identified. The Hansen test yields a J-statistic which is distributed as $\chi 2$ under the null hypothesis of the validity of the instruments. This indicates that the Hansen test rest should not reject the null hypothesis, which is consistent with the results in the empirical study.

Female independent directors can be just rubber stamps. That explains why people call these independent directors

"rubber-stamps." Independent directors are supposed to play the role of keeping large shareholders and top managers in check, as the owners of the firm (e.g., controlling shareholders in China) tend to act in their own interest or make wrong managerial judgments. However, independent directors seem to raise few objections at board meetings, and they are often called as "rubber-stamps" or "vase independent directors" (flower vase are often used to describe ladies who are beautiful, but not intelligent or not experts in that area) in China. Thus, if female independent directors are vase independent directors, they cannot play monitoring role effectively and therefore have no effect on firm performance.

The coefficients of some control variables are consistent with the expectation. For example, small firms perform better because they have more investment opportunities. Firms with high leverage perform better because of the tax shield benefits.

Table 4.6.2 (1) The Relationship Between Female Directors (FDs) and Firm Performance (system GMM)

This table presents the results of system GMM. The dependent variable is TQ_01. The sample period is from 1999 to 2016 and the sample consists of all listed firms listed on Main board in Chinese stock exchange excluding financial firms. Variable definitions are provided in Appendix. All variables are winsorized at the 1st and 99th percentile values. Robust standard errors are provided in parentheses.

VARIABLES	(1) Model	(2) Model	(3) Model	(4) Model
L.TQ_01	0.468***	0.384***	0.386***	0.396***
	(4.813)	(4.911)	(4.973)	(4.608)
L.TQ_02	0.393***	0.375***	0.372***	0.389***
	(4.919)	(4.876)	(4.821)	(4.851)
FD_DUM	-0.135**			
	(-2.032)			
FD_NUM		-0.043		
		(-1.452)		
FD_PER			-0.433	
			(-1.588)	
FCEO_DUM				0.000
				(0.489)
BS	-0.006	-0.037*	-0.043**	-0.037*
	(-0.219)	(-1.849)	(-2.110)	(-1.700)
IN_DIR	0.092	0.124**	0.120**	0.124**
	(1.335)	(2.265)	(2.221)	(2.140)
FS	-0.230**	-0.375***	-0.366***	-0.342***
	(-2.054)	(-4.788)	(-4.631)	(-3.941)
LEV	0.628***	0.429**	0.430**	0.449**
	(2.620)	(2.262)	(2.284)	(2.196)
TANGI	-0.389	-0.026	-0.050	-0.066
	(-1.224)	(-0.106)	(-0.204)	(-0.260)
GROWTH	-1.437***	-0.788***	-0.800***	-0.927***
	(-4.793)	(-3.814)	(-3.963)	(-4.167)
CAPEX	1.463	0.994	1.009	0.998
	-0.006	-0.037*	-0.043**	-0.037*
Constant	0.982***	1.687***	1.735***	1.572***
	(3.003)	(6.793)	(6.852)	(5.926)
Observations	20,099	18,390	18,390	18,390
Number of stkcd	1,516	1,454	1,454	1,454
Ar1	-6.391	-6.859	-6.958	-6.693
P-value	0.000	0.000	0.047	0.136
Ar2	-0.719	-1.303	-1.310	-1.492
P-value	0.472	0.193	0.000	0.000
Hansen	17.439	23.259	23.877	26.146
P-value	0.293	0.056	0.190	0.025

Table 4.6.2 (2): The Relationship Between Female Independent Directors (FID) and Firm Performance (system GMM)

This table presents the results of system GMM. The dependent variable is TQ_01. The sample period is from 1999 to 2016 and the sample consists of all listed firms listed on Main board in Chinese stock exchange excluding financial firms. Variable definitions are provided in Appendix. All variables are winsorized at the 1st and 99th percentile values. Robust standard errors are provided in parentheses.

VARIABLES		(1) Model	(2) Model	(3) Model	
L.TQ_01		0.424***	0.433***	0.435***	
		(4.587)	(4.717)	(4.749)	
L2.TQ_02		0.389***	0.381***	0.381***	
		(4.922)	(4.852)	(4.845)	
FID_DUM		-0.030			
		(-0.648)			
FID_NUM			0.004		
			(0.132)		
FID_PER				0.119	
				(0.319)	
BS		0.001	0.002	-0.001	
		(0.037)	(0.060)	(-0.035)	
IN_DIR		-0.097	-0.100	-0.100	
		(-1.249)	(-1.294)	(-1.288)	
FS	-0.434***	-0.433***	-0.403***	-0.403***	-0.403***
	(-4.973)	(-4.973)	(-4.978)	(-4.778)	(-4.778)
LEV		0.530***	0.530***	0.530***	
		(3.077)	(3.083)	(3.074)	
TANGI		-0.395	-0.408	-0.406	
		(-1.524)	(-1.567)	(-1.557)	
GROWTH		-0.558**	-0.558**	-0.567**	
		(-2.032)	(-2.030)	(-2.034)	
CAPEX		-0.585	-0.586	-0.557	
		(-0.631)	(-0.631)	(-0.594)	
Constant		1.610***	1.623***	1.617***	
		(6.087)	(6.270)	(6.108)	
Observations		18,390	18,390	18,390	
Number of stkcd		1,454	1,454	1,454	
Ar1		-6.394	-6.554	-6.572	
P-value		0.000	0.000	0.134	
Ar2		-1.509	-1.498	-1.498	
P-value		0.131	0.208	0.000	
Hansen		17.486	17.972	18.099	
P-value		0.231	0.134	0.202	

4.7 Further Check: Market Reaction to the Resignation of Female Independent Directors (FIDs)

I also investigate the market reaction to the resignation of female IDs using the Regulation 18 and 11 as an exogenous shock to board composition. If gender matters, I expect that the market responds negatively to the announcement of female IDs.

Table 4.7.1(1) shows that there is no significant market reaction to the announcement of resignation of FIDs as the abnormal return is not significant from zero on the announcement date. Table 4.7.1(2) also shows that there is no significant market reaction to the announcement of resignation of FIDs as the cumulative abnormal return is not significant across various windows. Overall, the market reaction results indicate that investors do not view female independent directors value creator, which is consistent with the previous regression analysis results.

4.7.1 Market Model

Table 4.7.1 (1): FID (female independent director) AR results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	-5	-4	-3	-2	-1	-0	1	2	3	4	5	6	7	8	9	10	15	20
_cons	0.005	0.004	0.001	0.001	0.006	0.033	0.032	0.033	0.034	0.032	0.034	0.033	0.031	0.033	0.033	0.033	0.032	0.028
	(0.76)	(0.52)	(0.18)	(0.19)	(0.70)	(1.22)	(1.19)	(1.25)	(1.27)	(1.20)	(1.24)	(1.20)	(1.15)	(1.20)	(1.20)	(1.22)	(1.18)	(1.00)
N	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316

Figure 11: FID (female independent director) AR

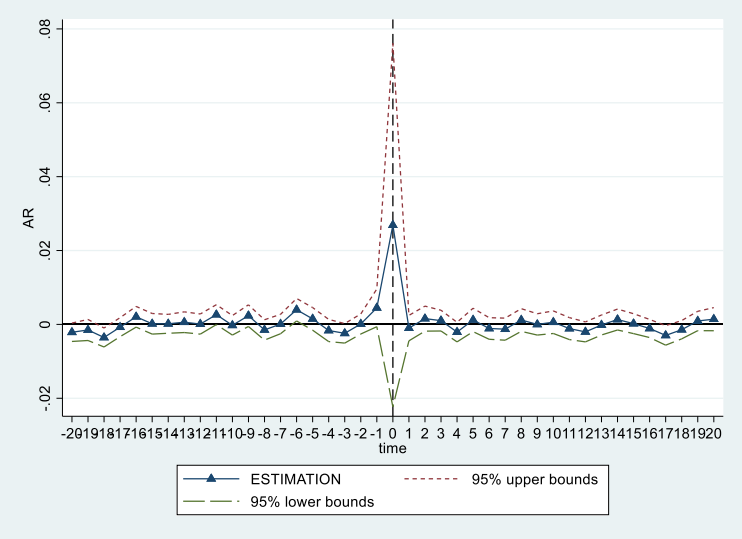
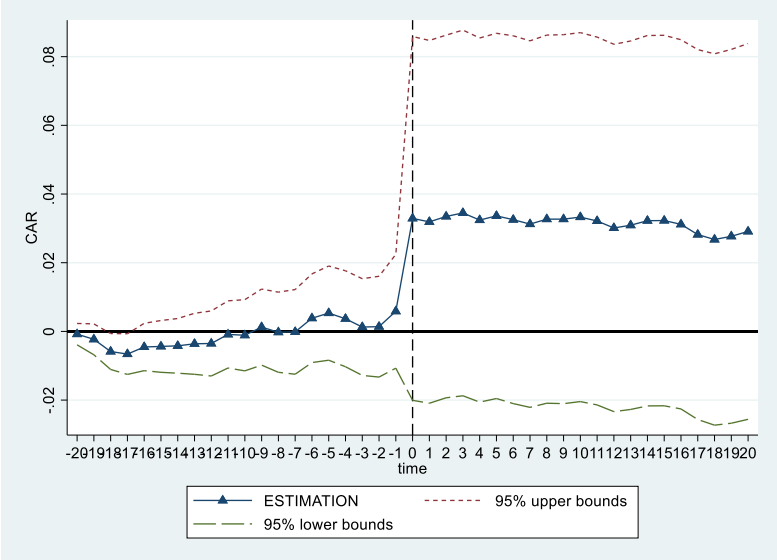


Table 4.7.1 (2): FID (female independent director) CAR results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	[-1,1]	[-2,2]	[-3,3]	[-4,4]	[-5,5]	[-10,10]	[-15,15]	[-20,20]
_cons	0.031	0.032	0.029	0.027	0.029	0.034	0.038	0.033
	(1.23)	(1.24)	(1.15)	(1.09)	(1.14)	(1.29)	(1.42)	(1.22)
N	316	316	316	316	316	316	316	316

Figure 12: FID (female independent director) CAR



4.8 Robustness Check

4.8.1 Alternative Dependent Variable

We use the ROA to replace Tobin'sQ as alternative dependent variable and re-run regression. The methods used is Fixed Effect analysis. The main results are shown in Table 4.8.1(1) and Table 4.8.1(2).

The Relationship Between Female Directors and Firm Performance (Fixed Effect)

$$FIRM\_PERFORMANCE_{it} = \beta_0 + \beta_1 FD\_NUM_{it} + \beta_2 FD\_PER_{it} + \beta_3 FD\_DUM_{it} + \beta_4 FCEO\_DUM_{it} + \beta_5 FS_{it} + \beta_6 LEV_{it} + \beta_7 TANGI_{it} + \beta_8 GROWTH_{it} + \beta_9 CAPEX_{it} + \beta_{10} BS_{it} + \beta_{11} IN\_DIR_{it} + \beta_{12} DUM\_YEAR_{it} + \alpha_i + \lambda_t + \varepsilon_{it}$$

Model 10

In this model, the dependent variable is **FIRM_PERFORMANCE** and is measured by **ROA**. The key independent variable is **FD_NUM** represents the number of Female directors on board. **FD_PER** represents the percent of woman directors on board. **FD_DUM** is a dummy variable and equals one when the board have female director sitting in the board, the dummy variables equals 0 when the board does not have female director sitting in the board. **FCEO_DUM** is a dummy variable, the dummy variable equals one when the board have female CEO sitting in the board, the dummy variables equals zero when the board not have female CEO sitting in the board. The control variables are same with before. Thus, our regression model uses Fixed effect regression.

Effect of Female Independent Directors (FID) on Firm Performance (Fixed Effect)

$$FIRM\_PERFORMANCE_{it} = \beta_0 + \beta_1 FID_NUM_{it} + \beta_2 FID\_PER_{it} + \beta_3 FID\_DUM_{it} + \beta_4 FS_{it} + \beta_5 LEV_{it} + \beta_6 TANGI_{it} + \beta_7 GROWTH_{it} + \beta_8 CAPEX_{it} + \beta_9 BS_{it} + \beta_{10} IN\_DIR_{it} + \beta_{11} DUM\_YEAR_{it} + \alpha_i + \lambda_t + \varepsilon_{it}$$

Model 11

In this model, the dependent variable is **FIRM_PERFORMANCE** and is measured by **ROA**. The key independent variable is **FID_NUM** is the number of independent female director on board. **FID_PER** is the percent of female independence director on board. **FID_DUM** is a dummy variable, the dummy variables equals one when the board has independent female director sitting in the board, the dummy variables equals zero when the board does not have independent female director sitting in the board. The control variables are same with before. Thus, our regression model uses Fixed effect regression.

Table 4.8.1(1): The Relationship Between Female Directors (FD), Female CEO, and Firm Performance (Fixed Effect)

This table presents the results of FE regression. The dependent variable is ROA. The sample period is from 1999 to 2016 and the sample consists of all listed firms listed on Main board in Chinese stock exchange excluding financial firms. Variable definitions are provided in Appendix. All variables are winsorized at the 1st and 99th percentile values. Robust standard errors are provided in parentheses.

VARIABLES	(1) Model	(2) Model	(3) Model	(4) Model
FD_DUM	-0.000			
	(0.001)			
FD_NUM		-0.000		
		(0.000)		
FD_PER			0.005	
			(0.005)	
FCEO_DUM				**0.005***
				(0.003)
BS	-0.000	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
IN_DIR	0.001	0.001	0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
FS	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
LEV	-0.169***	-0.169***	-0.169***	-0.168***
	(0.003)	(0.003)	(0.003)	(0.003)
TANGI	-0.052***	-0.052***	-0.052***	-0.052***
	(0.004)	(0.004)	(0.004)	(0.004)
GROWTH	0.019***	0.019***	0.019***	0.018***
	(0.001)	(0.001)	(0.001)	(0.001)
CAPEX	0.149***	0.149***	0.149***	0.147***
	(0.009)	(0.009)	(0.009)	(0.010)
DUM_YEAR	Yes	Yes	Yes	Yes
Constant	0.122***	0.122***	0.122***	0.117***
	(0.004)	(0.004)	(0.004)	(0.005)
Observations	21,921	21,921	21,921	17,768
R-squared	0.265	0.265	0.266	0.258
Number of stkcd	1,589	1,589	1,589	1,550
Adj. R-squared	0.207	0.207	0.207	0.186

Table 4.8.1(2): The Relationship Between Female Independent Directors (FID) and Firm Performance (Fixed Effect)

This table presents the results of FE regression. The dependent variable is ROA. The sample period is from 1999 to 2016 and the sample consists of all listed firms listed on Main board in Chinese stock exchange excluding financial firms. Variable definitions are provided in Appendix. All variables are winsorized at the 1st and 99th percentile values. Robust standard errors are provided in parentheses.

VARIABLES	(1) Model	(2) Model	(3) Model
FID_NUM	0.000		
	(0.001)		
FID_DUM		-0.001	
		(0.001)	
FID_PER			0.005
			(0.008)
BS	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
IN_DIR	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
FS	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
LEV	-0.169***	-0.169***	-0.169***
	(0.003)	(0.003)	(0.003)
TANGI	-0.052***	-0.052***	-0.052***
	(0.004)	(0.004)	(0.004)
GROWTH	0.019***	0.019***	0.019***
	(0.001)	(0.001)	(0.001)
CAPEX	0.149***	0.149***	0.149***
	(0.009)	(0.009)	(0.009)
DUM_YEAR	Yes	Yes	Yes
Constant	0.122***	0.122***	0.122***
	(0.004)	(0.004)	(0.004)
Observations	21,921	21,921	21,921
R-squared	0.265	0.266	0.265
Number of stkcd	1,589	1,589	1,589
Adj. R-squared	0.207	0.207	0.207

4.8.2 Alternative Expected Return Model

In this section, I use Fama-French three factor and Fama-French five factor model as alternative models to calculate the expected returns. And accordingly, I calculate the AR and CAR separately. The main results do not change.

4.8.2.1 Fama-French Three Factor Model

Table 4.8.2.1(1): FID (female independent director) AR results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	-5	-4	-3	-2	-1	-0	1	2	3	4	5	6	7	8	9	10	15	20
_cons	0.004	0.001	-0.001	-0.001	0.003	0.029	0.028	0.028	0.029	0.027	0.028	0.027	0.026	0.027	0.026	0.027	0.024	0.019
	(0.54)	(0.16)	(-0.14)	(-0.13)	(0.36)	(1.08)	(1.03)	(1.05)	(1.07)	(0.99)	(1.03)	(0.98)	(0.96)	(0.99)	(0.95)	(0.97)	(0.87)	(0.68)
N	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316

Figure 13: FID (female independent director) AR

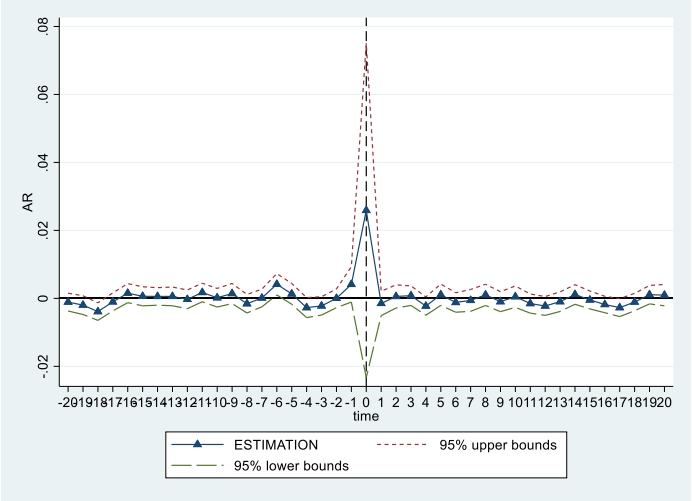
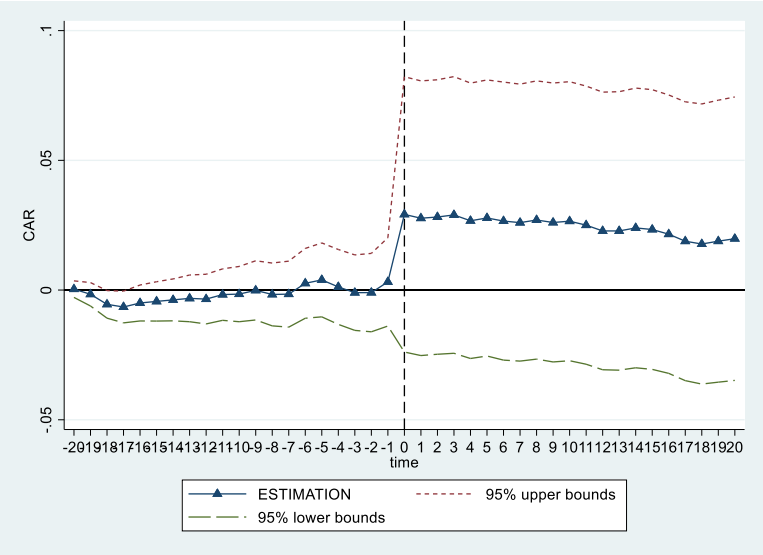


Table 4.8.2.1(2): FID (female independent director) CAR results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	[-1,1]	[-2,2]	[-3,3]	[-4,4]	[-5,5]	[-10,10]	[-15,15]	[-20,20]
_cons	0.030	0.030	0.028	0.025	0.027	0.031	0.035	0.029
	(1.18)	(1.18)	(1.11)	(1.00)	(1.05)	(1.19)	(1.30)	(1.08)
N	316	316	316	316	316	316	316	316
r2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
r2_a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 14: FID (female independent director) CAR



4.8.2.2 Fama-French Five Factor Model

Table 4.8.2.2(1): FID (female independent director) AR results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	-5	-4	-3	-2	-1	-0	1	2	3	4	5	6	7	8	9	10	15	20
_cons	-0.004	-0.006	-0.008	-0.008	-0.004	0.021	0.020	0.021	0.022	0.020	0.021	0.019	0.019	0.019	0.018	0.018	0.014	0.010
	(-0.42)	(-0.74)	(-0.95)	(-0.90)	(-0.43)	(0.79)	(0.73)	(0.79)	(0.79)	(0.76)	(0.79)	(0.71)	(0.69)	(0.71)	(0.67)	(0.67)	(0.50)	(0.35)
N	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316	316

Figure 15: FID (female independent director) AR

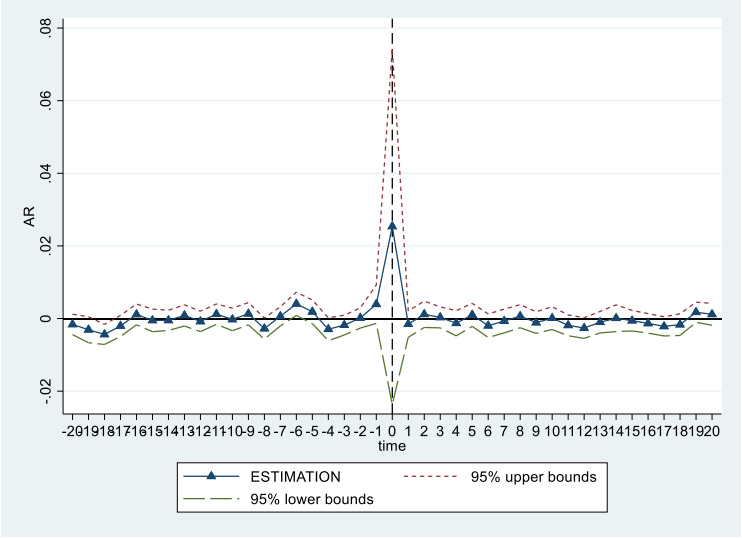
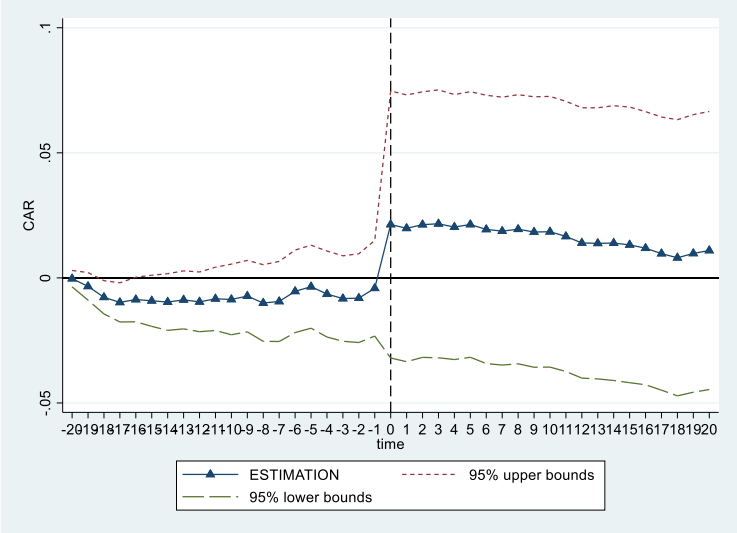


Table 4.8.2.2(2): FID (female independent director) CAR results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	[-1,1]	[-2,2]	[-3,3]	[-4,4]	[-5,5]	[-10,10]	[-15,15]	[-20,20]
_cons	0.029	0.030	0.028	0.025	0.027	0.030	0.030	0.021
	(1.16)	(1.17)	(1.11)	(0.99)	(1.06)	(1.15)	(1.14)	(0.79)
N	316	316	316	316	316	316	316	316
r2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
r2_a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 16: FID (female independent director) CAR



4.9 Conclusion

This chapter investigates the impact of female (independent) directors on firm performance. Different models lead to different results. OLS estimation results indicate that both female directors and female independent directors have impact on firm performance. Fixed effect estimation results indicate that female directors have no impact on firm performance, but female independent directors have impact on firm performance. However, system GMM results indicate both female directors and female independent directors have no impact on firm performance. Given that OLS estimation results did not consider endogeneity issue, fixed effect estimation results have strong assumption about the error term and independent variables. The system GMM results are more reliable, particularly considering the dynamic characteristics of the model. Female independent directors can be just rubber stamps. That explains why people call these independent directors "rubber-stamps." Independent directors are supposed to play the role of keeping large shareholders and top managers in check, as the owners of the firm (e.g., controlling shareholders in China) tend to act in their own interest or make wrong managerial judgments. However, independent directors seem to raise few objections at board meetings, and they are often called as "rubber-stamps" or "vase independent directors" (flower vase are often used to describe ladies who are beautiful, but not intelligent or not experts in that area) in China. Thus, if female independent directors are vase independent directors, they cannot play monitoring role effectively and therefore have no effect on firm performance. Overall, the main finding of this chapter is that there is no association between female (independent) directors and firm performance.

4.10 Appendix

Table 4.10: Variables Explanation

Dependent Variables	
TQ_01	Tobin's Q is defined as market value of total assets divided by book value of total assets. TQ_01 using the 30% of tradable shares as the proxy of market price of corresponding non-tradable shares.
TQ_02	using the 30% of tradable shares as the proxy of market price of corresponding non-tradable shares.
TQ_03	using the net asset value per share as the proxy of market value of corresponding non-tradable shares.
TQ_04	using the market price of tradable shares as the proxy of market price of corresponding non-tradable shares.
MTB	represents market-to-book ratio and it is defined as the market value of total equity divided by the book value of total equity.
ROA	return on assets, which is defined as net income over total assets.
Independent Variables	
FD_NUM	represents the number of female directors on board.
FD_PER	represents the percent of woman directors on board.
FD_DUM	a dummy variable and equals one when the board have female director sitting in the board, the dummy variables equals 0 when the board does not have female director sitting in the board.
FID_NUM	the number of independent female directors on board.
FID_PER	the percent of female independence director on board.
FID_DUM	a dummy variable, the dummy variables equals one when the board has independent female director sitting in the board, the dummy variables equals zero when the board does not have independent female director sitting in the board.

FCEO_DUM	a dummy variable, the dummy variable equals one when the board have female CEO sitting in the board, the dummy variables equals zero when the board not have female CEO sitting in the board.
D1_ FD	a dummy variable equals one when the board has one female director sitting in the board, and zero otherwise.
D2_ FD	a dummy variable, equals one when the board has two female directors sitting in the board, and zero otherwise.
D3_ FD	a dummy variable, equals one when the board has three female directors sitting in the board, and zero otherwise.
D1_FID	a dummy variable equals one when the board has one independent female director sitting in the board, and zero otherwise.
D2_FID	a dummy variable, equals one when the board has two independent female directors sitting in the board, and zero otherwise.
D3_FID	a dummy variable, equals one when the board has three independent female directors sitting in the board, and zero otherwise.
Control Variables	
FS	indicates firm size which is defined as total assets.
LEV	indicates leverage which is defined as the ratio of total long-term liabilities to total assets.
TANGI	indicates tangibility which is defined as the ratio of fixed assets to total assets.
BS	indicates board size which is defined as the total number of directors on the board.
IN_DIR	indicates the number of independent directors on the board.

Chapter 5 DISCUSSION AND CONCLUSION

5.1 Introduction

Board of directors have been studied extensively in corporate governance literature. Some literature discusses the role of board composition. For example, Guner, Malmendier, and Tate (2008) present a research on the *financial outside directors*. Baker and Gompers (2003) study the *venture capital investors* as directors. In addition, some other studies also discuss the CEOs as outside directors of other companies. Fich (2005) finds that the market response to the adding *CEOs of well-performing firms* to the board is positive. Fahlenbrach et al. (2010) show that the company's performance is down when the *interlocking directorates* joined the company. Seary, and Tuna (2005) present that *interlock directors* receive abnormally high pay. Several other papers investigate the *lobar representation* on the board, such as Faleye et al (2006). However, little literature discusses board composition from the perspective of academic professors sitting on the board as independent directors. This is one focus of this dissertation.

In addition, the literature on the corporate governance role of female directors is still inconclusive. For example, Carter, Simkings, and Simpson (2003) and Campbell and Minguez-Vera (2008) find that the percentage of female directors has positive impact on firm performance. Levi, Li, Zhang (2014) find that female directors are beneficial in creating shareholder value through reducing bid premium. Liu, Wei, and Xie (2014) find a positive association between female directors and firm performance. On the contrary, Ahern and Dittmar (2012), Bohren and Staubo (2014) document that imposing the quota of 40% female directors sitting on the board is detrimental to the firm value. Adams and Ferreira (2009) find a positive association between female directors and corporate governance, such as attending board meeting and playing monitoring role. However,

they did not find evidence about the positive association between female directors and firm performance. Triana, Miller, and Trzebiatowski (2013) show that board gender diversity is a double-edged sword as it depends on the firm performance and the power of female directors. Thus, another focus of this dissertation is about corporate board composition from the perspective of the female (independent) directors.

The first objective of this dissertation is to investigate the corporate governance role of academic independent directors (AIDs, hereafter). The second is to investigate the corporate governance role of female (independent) directors.

To achieve these objectives, this dissertation focuses on the following research questions. Firstly, it investigates the corporate governance role of AIDs, particularly focusing on the relationship between AIDs and firm performance. Secondly, it investigates the market reaction to the resignation of independent directors (i.e., IDs) and academic independent directors (i.e., AIDs). Thirdly, it investigates the corporate governance role of female (independent) directors, particularly focusing on the relationship between female (independent) directors and firm performance.

In this chapter, I present a conclusion of the main findings of this thesis. Section 5.2 discusses and summarizes main research findings. 5.3 discusses the limitation of this thesis. 5.4 explores the future research areas. 5.5 concludes.

5.2 Summary of research findings

Firstly, overall, this study finds no evidence about the influence of AIDs on firm performance. AIDs have influence on firm performance only when AIDs hold senior academic position, such as PhD supervisor post. This study uses various methods to do data analysis and find the similar results. These results are not consistent with previous studies. The possible reasons might be: Firstly, academic directors might have no enough time on playing advising and monitoring role due to their busy work in research and teaching in universities their serve. Secondly, AIDs are nominated by members of nomination committee and appointed by shareholders. The effectiveness of monitoring of AIDs is reduced and limited if firms are controlled by controlling shareholders as essentially AIDs are appointed by controlling shareholders and represent the interest of controlling shareholders rather than minority shareholders. This might be the case in this study as many Chinese listed companies are controlled by large controlling shareholders. Thirdly, AIDs cannot play an effective monitoring role as they receive their service fees from companies they serve. As the Bible says, "You shall not take gift, for gift blinds the wise, and perverts the words of the righteous" (Exodus, 23:8). Overall, AIDs cannot play effective corporate governance role and have no impact on firm performance.

Secondly, the market reaction to the resignation of AIDs is positive. This result is opposite to the expectation if AIDs are beneficial to the firm. This is because if AIDs are beneficial to the firm, investors should view the departure of the AIDs as bad news and the market should respond negatively to the resignation of AIDs. However, this study finds the opposite results. This indicates that investors do not interpret this as an improvement in the corporate governance structure. The

reason behind this could be the fact that this "resignation wave" was not driven by the spontaneous need of listed companies for improving their internal governance structure. What's more, this "resignation wave" was not targeted at or carried out to improve the internal governance of listed companies. Rather, it is just a part of the "prescribed actions" under the requirement of party discipline. Therefore, investors expect it to do little in changing the current governance structure of Chinese listed companies fundamentally. That being said, by introducing the independent director system into China's corporate governance structure in 2001, China Securities Regulatory Commission was intended to lower the agency cost between the management personnel and small-and-medium shareholders of listed companies, whiling putting restrictions on the tunneling acts of large shareholders with the professional third-party identity brought by independent directors, thereby mitigating the agency conflict in corporate governance to protect the interests of investors, especially small and medium investors. Therefore, government regulatory authorities must probe deeper into further improving the independent director system, such as promoting the professionalization of independent directors, including setting position-related thresholds, building an education system, establishing assessment mechanism, and building industry associations for independent directors.

Thirdly, this study finds no evidence about the corporate governance role of female (independent) directors. Female independent directors can be just rubber stamps. That explains why people call these independent directors "rubber-stamps." Independent directors are supposed to play the role of keeping large shareholders and top managers in check, as the owners of the firm (e.g., controlling shareholders in China) tend to act in their own interest or make wrong managerial

judgments. However, independent directors seem to raise few objections at board meetings, and they are often called as "rubber-stamps" or "vase independent directors" (flower vase are often used to describe ladies who are beautiful, but not intelligent or not experts in that area) in China. Thus, if female independent directors are vase independent directors, they cannot play monitoring role effectively and therefore have no effect on firm performance.

5.3 Limitations

The first limitation (possibly the most important limitation) of this dissertation is to how draw causal inference. Even though I have already tried various methods to address endogeneity issue, this is not perfect. I know that the best strategy to draw causal inference is to use natural experiment. However, given that this is social science research, it is very difficult to do natural experiment, if it is not impossible. The second limitation is that some new methods were not attempted to use in this dissertation such as regression discontinuity design (RDD) used to address endogeneity issue, propensity score matching (PSM) used to find the matching group.

5.4 Future Research Areas

Some research topics can be used as future research areas. For example, the impact of AIDs on various corporate decisions including financing decision, investment decision, payout decision, M&A decision etc. In addition, it is very interesting to investigate corporate governance role of AIDs focusing on the influence of AIDs on earnings management, tax avoidance, CEO compensation etc. Similarly, it is also interesting to investigate the influence of female (independent) directors on various corporate decisions and the corporate governance role of female

(independent) directors.

5.5 Summary

The research conclusions of this paper have important policy implications. Under the special condition of highly centralized shareholding structure of Chinese listed companies characterized by the dominance of single shareholder, how to design a competent governance mechanism to curb the infringement of large shareholders on small-and-medium shareholders and protect their interests is an important policy target for the regulating authorities of the capital market. This paper examined the effectiveness of the independent director governance mechanism of listed companies in China from a brand new perspective of the firm value, The research in this paper also provides new perspectives and evidences for understanding and evaluating the policy effect of independent director system reform of listed companies in China.

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